MOBILE

A MOBIDIC COBOL COMPILER

SECOND QUARTERLY PROGRESS REPORT

1 May 1962 to 1 October 1962

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Technical Requirements
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SECTION I

PURPOSE

1.1 MOBILE, A COBOL COMPILER FOR THE DATA PROCESSING NEEDS OF THE ARMY SIGNAL CORPS

The objective of this procurement is to produce, for MOBIDIC computers (C, D, 7A) a COBOL compiler capable of accepting a Source Program written in COmmon Business Oriented Language, and compiling an Object Program capable of being operated on the above computers.

This procurement will result in delivery to the U.S. Army Signal Corps of a COBOL Compiler (MOBILE I) as specifically defined in Required-COBOL 1961 and with certain features as specified in Elective-COBOL 1961. The MOBILE I Task is being implemented by the Applied Programming Department of the Programming and Analysis Laboratory.

SECTION II

ABSTRACT

The program during this reporting period included unit testing and the beginning of package testing for the MOBIDIC MOBILE Runs. Runs, 1.0, 1.1, 2, 4, 5 and the Non I/O Generators are ready to begin or have begun package testing. The segmentation of Run 1.3 and the I/O Generator is complete. New coding is complete for the Sort Merge Routines. The following Areas are Covered in this report:

- MODIFICATION OF RUNS
- MOBILE I SYSTEMS TAPE
- TAPE ALLOCATION AND USAGE

SECTION III

PUBLICATIONS, LECTURES, REPORTS AND CONFERENCES

3.1 PUBLICATIONS

None

3.2 LECTURES

1.	Title:	Introduction to COBOL
	Lectures:	Basic COBOL, Practice problems and solutions
	Location:	Fort Monmouth, New Jersey
	Date:	11 June 1962 – 13 June 1962
2.	Title:	COBOL Training Course
	Lectures:	Detailed discussion of four main divisions of COBOL Source Program and statement of practice problem.
	Location:	Fort Monmouth, New Jersey
	Date:	6 August 1962 – 10 August 1962
3.	Title:	MOBIDIC MOBILE I, a COBOL compiler
	Lectures	A discussion of the phases and functions of the MOBIDIC MOBILE compiler
	Location:	Fort Monmouth, New Jersey
	Date:	16 August 1962

3.3 REPORTS

1. Monthly Letter Report 1 June 1962
2. Monthly Letter Report 28 June 1962
3. Monthly Letter Report 30 July 1962
4. Monthly Letter Report 7 September 1962

3.4 CONFERENCES

1.	Date:	28 May 1962
	Location:	Fort Monmouth, New Jersey
	Participants:	Signal Corps, Sylvania
	Subject:	Overall Project Status
2.	Date:	21 June 1962
	Location:	Sylvania, Needham
	Participants:	Signal Corps, Sylvania
	Subject:	Acceptance Testing
3.	Date:	13 August 1962 – 15 August 1962 17 August 1962
	Location:	Fort Monmouth, New Jersey
	Participants:	Signal Corps, Sylvania
	Subject:	Possible Solutions of Acceptance Test Problem
4.	Date:	23 August 1962
	Location:	Sylvania, Needham
	Participants:	Signal Corps, Sylvania
	Subject:	Overall Project Status
5.	Date:	28 August 1962
	Location:	Sylvania, Needham
	Participants:	Signal Corps, Sylvania
	Subject:	Overall Project Status

SECTION IV

FACTUAL DATA

4.1 GENERAL DESCRIPTION

Further development of the MOBIDIC MOBILE I Compiler and its current status are described in detail in this section. The task breakdown is as follows:

- Description of Run Modifications
- Auxiliary program descriptions

4.2 SYSTEM FLOWCHARTS AND TABLE DESCRIPTION

The reader is advised to read the System Flowchart and Table Descriptions of the 1st Quarterly Progress Report in conjunction with the Run Modifications described in Section 4.3.

4.2.1 Assembly Programs and Languages

Since mnemonic names and symbols are inherent in programming, it is appropriate at this time to describe briefly some of the Assembly Program and Languages used during this contract period. The first three Assembly Programs (DUST, 94AP, and MAP) are not contained in the COBOL Compiler whereas the second set of three Assembly Programs and Programming Language (MODAL, CAP, and MUST) is part and parcel of the COBOL Compiler.

4.2.1.1 DUST

DUST is the mnemonic name for the MOBIDIC D Unlimited Symbol Table Assembly Program. This assembly program was adapted from the 9400 Assembly Program for use on the MOBIDIC D computer. It is a more powerful and versatile assembler than MAP. A complete description of the features of DUST can be found in Sylvania Memo MC-TP-233.

4.2.1.2 94AP

94AP is the mnemonic name for the Sylvania 9400 Assembly Program. This assembly program was developed by Sylvania for use on Sylvania's 9400 computer. The basic function of any assembly program is to convert symbolic coding to the machine language and essentially, this is a one-to-one conversion as opposed to a many-to-one conversion inherent in compilers.

4.2.1.3 MAP

MAP is the mnemonic name for the MOBIDIC Assembly Program designed and developed primarily for the MOBIDIC A computer by Sylvania under Signal Corps contract. MAP can be used on the other MOBIDIC Computers, (e.g., C& 7A). This assembly program is not as powerful as 94AP or the DUST Assembler due to the limited hardware configuration of the specified computer, (e.g., 8K core memory and two magnetic tape units).

4.2.1.4 MODAL

MODAL is the mnemonic name for the MOBIDIC Assembly Language. This programming language makes possible the insertion of symbolic coding into COBOL statements in the Procedure Division through the ENTER option. MODAL is a subset of the MOBIDIC instruction set. The difference is that in MODAL no I/O instructions can be used and certain pseudo instructions are not allowed. The final report will contain a complete listing of allowable instructions. It should be noted that the format for ENTER generator is:

ENTER MODAL.

This ties together the language and its use in COBOL.

4.2.1.5 CAP(S)

CAP is the mnemonic name for the Compiler Assembly Program which constitutes runs 7 and 8 of MOBILE. The assembly phase is part of any compilation process which also includes card punching and listings. It can be said that CAP is a much smaller version of DUST and performs the same basic functions.

The user is not to confuse CAP with CAPS, the latter being the definition for the major input in the Assembly Phase (CAP) of the Compiler. Each CAPS consists of two data words which are processed into one word in machine code.

4.2.1.6 MUST

MUST is the mnemonic name for the MOBILE Utility System Translator program. The function of this program is to assemble in a special manner the various subroutines that are used as prepackaged object code for certain COBOL statements. When it was realized that these prepackaged subroutines were all relativized to the first location and that many addresses must be filled in at object time, it was clear that a special purpose assembly program was required, and MUST was developed. The third quarterly will contain a complete section describing MUST and its operation.

4.2.2 Relationship of Languages and Assemblers

SOURCE LANGUAGE	ASSEMBLER	OBJECT LANGUAGE
9400 Symbolic Instructions	94AP	Machine Code
MOBIDIC Symbolic Instructions	DUST	Machine Code
	or	
	MAP*	Machine Code
MOBIDIC Symbolic Instructions	MUST	CAPS
MODAL	Runs 6, 7, 8	Machine Code
CAPS	Runs 7, 8	Machine Code

*Not all symbolic instructions are acceptable

4.3 RUN MODIFICATION DESCRIPTIONS

Run 1.0 is complete and its program listing is available in Appendix A. Modification on Runs 1.3, 2.4, 3 and 5 is described in detail in this section. Below is a general outline of the Run modifications:

1. Run 1.3 has been segmented into two sections, 1.3A and 1.3B.
2. Run 2 has been modified to replace the binary sort with an internal sort.
3. Run 4 has been modified to provide compatibility with the core memory capacity for the MOBIDIC Computer.
4. Run 3 modifications involves the Service Routines, segmentation of the Input/Output Generator, and the Non-Input/Output Generators.
5. Run 5 modification involves the use of the internal sort, a reduction in the size of the input buffer, and the addition of a merge phase.

4.3.1 Run 1.0 Modifications

See Run 1.0 Listing in Appendix A.

4.3.2 Run 1.1 Modifications

Modifications have been completed for Run 1.1. Modification was necessary due to the existence of several LXS instructions in the coding. All LXS instructions were changed to two LOD instructions. Any relative addressing using greater than 12 bits were replaced by a CLA and RPA sequence. The main modification was done in changing indexing instructions to make certain that they would execute properly with the MOBIDIC 12-bit index registers.

The Hollerith to FIELDATA Routine (HFC3) was added to Run 1.1. Previously it had been left in core memory by the Control Program. However, by reading in HFC3 as part of the individual runs, it was found that the available core memory space could be optimized.

4.3.3 Run 1.2 Modifications

During this reporting time period, Run 1.2 was completely debugged (with simple addressing information). Following the completion of unit testing, Run 1.2 was completely reassembled. Time then was spent debugging the new assembly and preparing it for entrance into the compiler system for the first time. At this point, there were many errors due to incompatability between Run 1.2 and the Control Program and other compiler runs. There were certain types of input errors which were detected, but not corrected properly by Run 1.2.

Once the incompatabilities were overcome and the system was running smoothly, the remainder of the reporting period was spent in assembling and debugging complex address functions.

4.3.4 Run 1.3 Modifications

Because core memory is not large enough to contain all the environmental data, Run 1.3 has been segmented into 2 sections, 1.3A and 1.3B. Now, the Data Name List is not in core during the operation of 1.3A, but is available for 1.3B. The size of the running code has caused no trouble to date.

4.3.4.1 Run 1.3A

The main function of 1.3A is to scan the Source Program and produce a new kind of temporary compressed generator call for use as input to 1.3B. This generator call contains the data-name, its character count, and its type, i.e., base name, subscript, or qualifier.

4.3.4.2 Run 1.3B

This segment of Run 1.3 uses the now available Data Name List and the temporary Compressed Generator Calls produced in 1.3A to make up the normal Compressed Generator Calls. Run 1.3B scans the Data Name List and obtains the location word for the data name entry in the temporary Generator Call. The location word is then placed in the final Generator Call.

4.3.4.3 Effects of the Segmentation

Subroutines PT160-168 of Run 1.3A which analyze the input have been changed. Subroutines PT164-PT166 are in Run 1.3B. New coding has been added to both segments to carry out the function of making up the new type generator call as well as to effect a smooth transition from 1.3A to 1.3B. A completely new PT166 has been written for 1.3B that now includes PT167. PT167 as such, no longer exists. A new PT164 has been written for 1.3A and PT164 has been modified for 1.3B.

Additional core space was made available when all non-Procedure Division words were removed from the Reserved Word List. Also, changes in the error routines contributed extra space. Subroutines PT150 and PT154 have been renamed PT180 and PT184, respectively.

Testing has begun on SUBSCRIPTed names and DECLARATIVES and analysis of some of the PERFORM options has started.

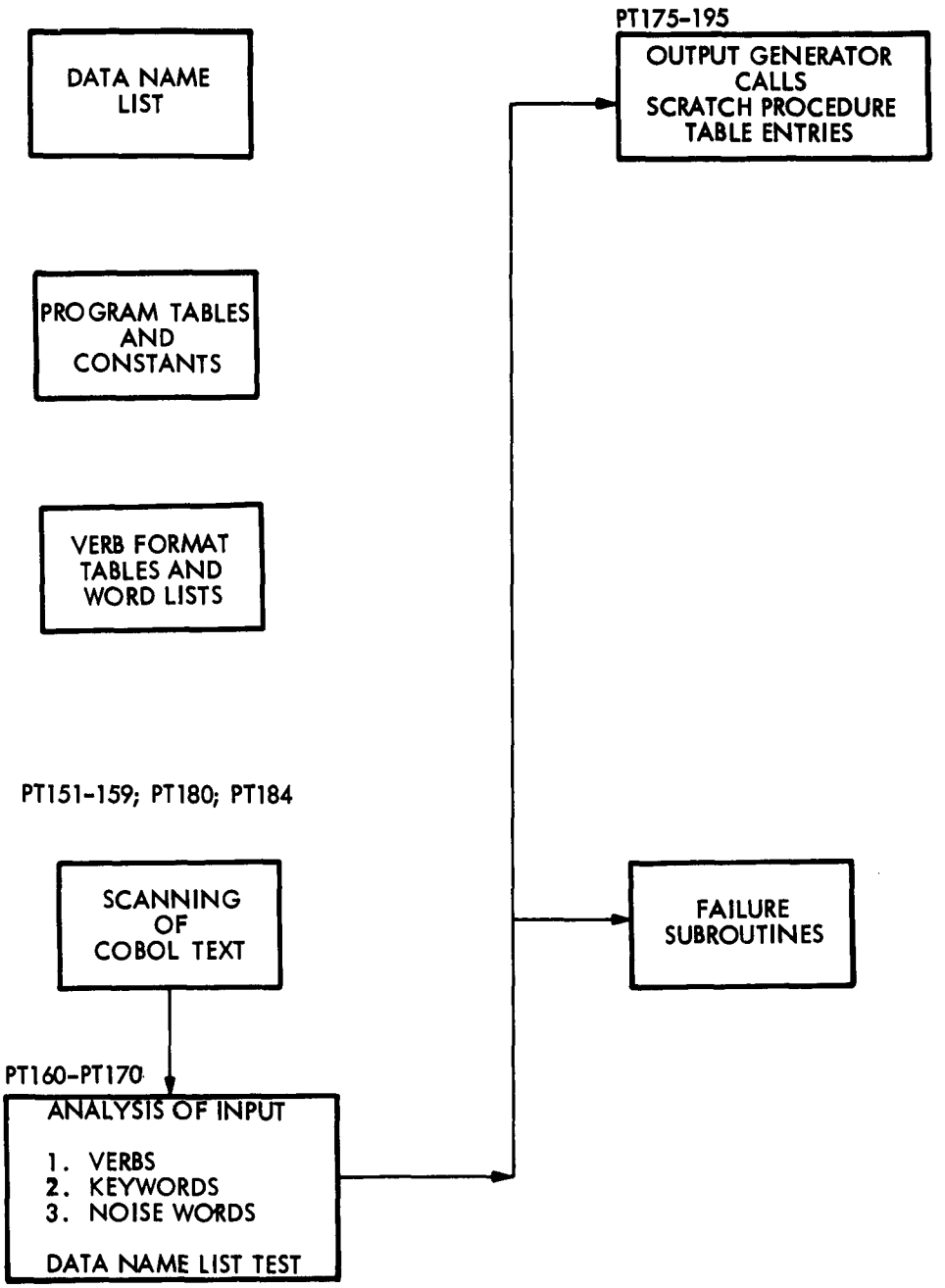

Figure 4-1. Run 1.3—Procedure Division Analysis

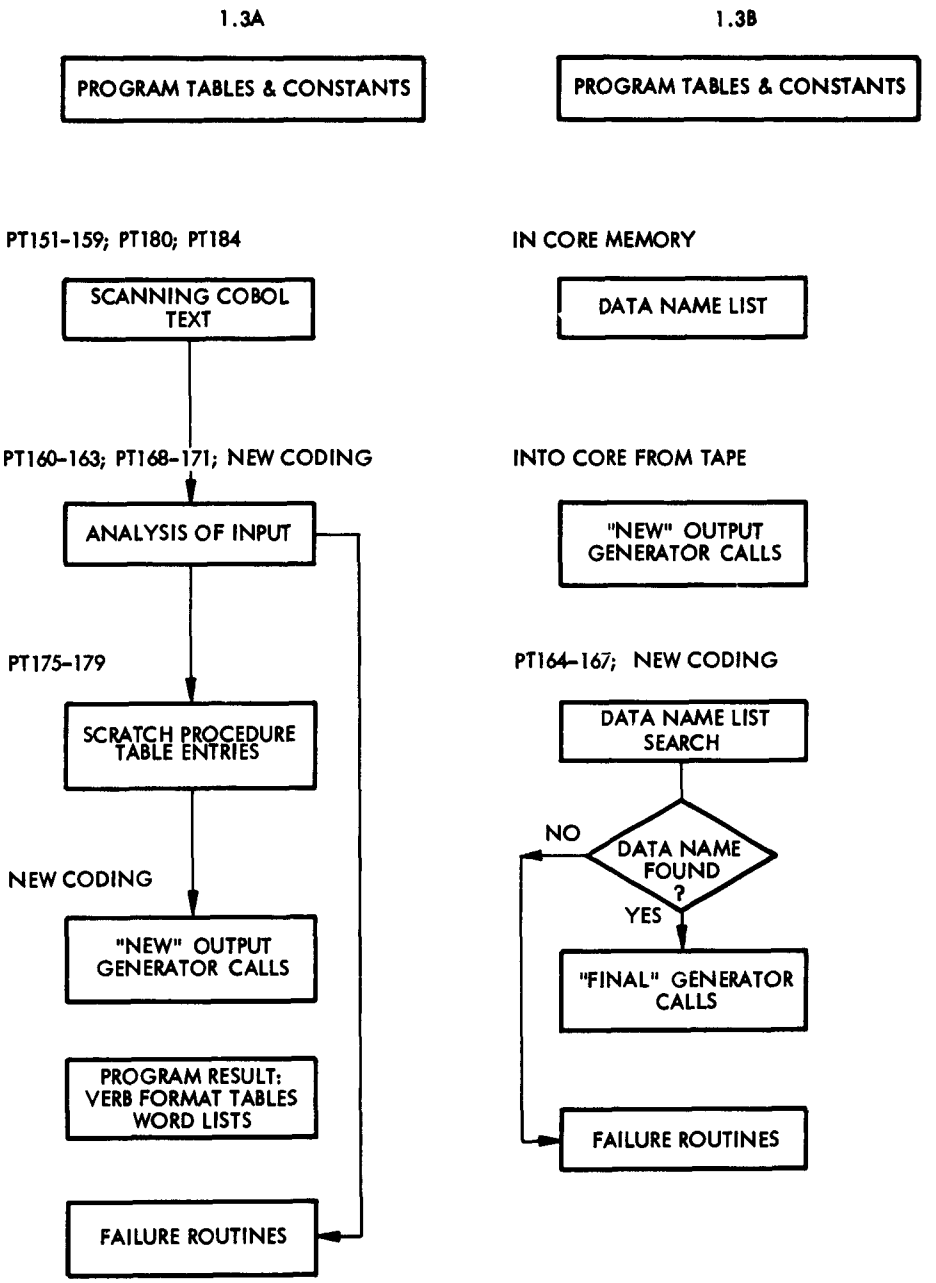

Figure 4-2. Run 1-3—Segmentation In MOBILE

4.3.5 Own Code General Discussion

The COBOL user may at times have difficulty in expressing in COBOL those debugged assembly language subroutines which he desires to use. However, the MOBILE system allows the user to include those assembly instructions called "Own Code" in his COBOL Procedure Division to represent those subroutines. This is done by means of the ENTER verb. The user must adhere to the own code restrictions defined in 4.3.5.4.

4.3.5.1 ENTER Declarative

An ENTER Declarative is used to introduce a block of symbolic coding in "Own Code" language into the COBOL Procedure Division. Each ENTER Declarative occupies an entire Section in the Declarative area. The Section header consists of the Section name, the keyword SECTION, followed by a period and then the ENTER statement. The ENTER statement consists of the keywords ENTER MODAL. The ENTER coding in "Own Code" language is executed only by a PERFORM verb in the Procedure Division which refers to the section name. The "Own Code" instructions must begin on the line after the section header. The keywords ENTER COBOL must follow the final "Own Code" instruction. The next line must be either a new section header or the keywords, END DECLARATIVES.

4.3.5.2 Own Code Formats

"Own Code" may be used any number of times within the main body of a COBOL Procedure Division or in the Declarative Section. Each time it is used it must be preceded by the words ENTER MODAL and ended with the words ENTER COBOL. The programmer must use the following formats.

The format for the ENTER MODAL is free form in that no fixed format is assumed by the translation division of MOBILE.

The format for each "Own Code" instruction in an ENTER statement is fixed, however, as follows:

Column No.	Item
1-6	COBOL sequence number
7-12	Symbolic location
14-19	Operation code
21-76	Variable field and remarks
77-80	Program Identification

The format for ENTER COBOL is:

Column No.	Item
1-6	COBOL sequence number
14-24	ENTER COBOL

4.3.5.3 Own Code Implementation

The translation of "Own Code" instructions to CAPS is a three-pass assembly process. The instructions appear to Run 1.4A as 14 word fieldata input card images on magnetic tape. They are processed one at a time.

An ENTER USAGE will now be defined for future use as those "Own Code" instructions bound in the beginning with the key words ENTER MODAL and in the end with the keywords ENTER COBOL. There may be many ENTER USAGES within a COBOL program.

4.3.5.3.1 Pass I

During the first pass a Symbol table is created, andthe mnemonic operational codes within each image are converted to numeric. At the same time a relative line counter is maintained within the Symbol table. The first three words of each image are replaced by a two word CAP containing only CAP type, op code, and part number.

The variable field within each image is scanned for two consecutive blanks which terminate the field. If they are found, the remainder of the card image with the exception of the card count is discarded since it constitutes only remarks which are not processed by the MOBILE system other than appearing in the BSP listing. If they are not found, this means the variable field is continued on the next card image. Similar processing is done until card images for this ENTER USAGE have been exhausted or two blanks have been found.

Each processed card image along with the Symbol table, is now a pseudo-CAP which is the main output of Pass I. Upon completion of Pass I, the Symbol table is sorted on the characters of the name for use in Pass II.

4.3.5.3.2 Pass II

Each pseudo-CAP is now processed by passing its variable fields over the Symbol table until either a match is found or the table has been exhausted. For each match a Mobile Data operand for a self reference plus or minus, (*±), is inserted into the CAP. If each variable field within a pseudo-CAP leads to a match, a finished or complete CAP can be formed. If any variable field within a pseudo-CAP leads to a no match, that variable field must be carried along with its incomplete CAP to Pass III.

In either case each CAP must be headed by a literal name entry, to allow it to go through the MOBILE system. Each block of CPS in turn must be headed by a Generator Call header. When Pass II over the current ENTER USAGE has been completed, one of three paths of processing must be followed:

1. If more ENTER USAGES exist, then Pass I and Pass II processing over subsequent USAGES must be performed.

2. If no more ENTER USAGES and no references to data-names in Working Storage requiring a third Pass exist, Run 1.4B is entered.

3. If no more ENTER USAGES but references to data-names in Working Storage reguiring a third Pass, then Pass III must be entered.

4.3.5.3.3 Pass III

During Pass III all incomplete CAPS, (those with variable fields) are processed by passing them over the Data Name List as many times as there are memory loads of Data Name List. This results in either finding a match or not.

For each match a unique location word for this data name in the Data Design Table is obtained. The variable field is discarded and the location word is appended to its CAP.

For a no-match an entry is inserted into the BSP correction table using the card count mentioned in Pass I. A mobile data operand specifying constant

zero is then inserted into that portion of the CAP to which the variable field belongs. The user can spot check his Assembly listings and binary patch where necessary to avoid a recompilation.

Processing continues until all of the incomplete CAPS are converted into either complete CAPS or CAPS with location words attached which require further information in the form of data replies and hence are not yet complete.

In both cases a literal name header precedes each CAP and each output block of CAPS is headed with an ENTER generator call header. The exit to Run 1.4B is then performed.

4.3.5.4 Own Code Restrictions

A. An ENTER MODAL may be used in a Declarative Section or in the Main Body of the Procedure Division. The only difference is that in the Declarative Section a Section name followed by the keyword SECTION and a period must precede the key words ENTER MODAL for each ENTER USAGE.

B. The Own Code instructions must begin on the next line after the ENTER MODAL statement, which can be ended by a comma, a period or a space. After the final symbolic instruction there must be a line which contains a COBOL sequence number, and the keywords ENTER COBOL. The Procedure Division continues on the next line, starting in column 8 or 12 depending on whether a new Procedure name is given or the previous paragraph is continued.

C. The formats described in 4.3.5.2 must be followed.

D. Two consecutive spaces terminate the variable field, and anything which follows is considered to be remarks.

E. The Variable fields in "Own Code" may refer to symbolic locations within its ENTER USAGE or to data names in the Working Storage Section of the Data Division.

F. The variable fields in "Own Code" may not refer to data names, procedure names, or special names used elsewhere in the COBOL Program other than those data names in Working Storage. References to symbolic locations in other ENTER USAGES are not allowed.

G. Whenever a qualified data name in Working Storage is referenced, one and only one space must precede and follow the keyword IN or OF.

H. Qualification of a data name in Working Storage, if necessary, must be used but unnecessary qualification is permitted but not advised.

I. The pseudo-op ETC allowing continuation of the variable field across multiple cards is allowed. This will be useful in qualification of a Working Storage data name.

J. References to data names in Working Storage with OCCURS clauses are not permitted.

K. The "Own Code" user can only use the operational codes listed in Appendix B.

L. The variable field of an "Own Code" instruction can only contain numeric integers or 30 character data names. Numeric expressions involving addition, subtraction, multiplication, division or exponentiation are not allowed.

M. In the use of the OCT pseudo-op only numeric integers can be used.

N. No Input-Output instructions are allowed.

4.3.5.5 Own Code Tables

4.3.5.5.1 OW1N

A. Table name - "Own Code".

B. Table symbol - OW1N, set by Run 1.3.

C. No. of words/entry - 14 words.

D. No. of entries - one for each "Own Code" instruction used with an ENTER verb.

E. Table function - result of Hollerith to FIELDATA translation, used by Run 1.4A.

F. Table format

word 1:	COBOL sequence number or blank (05)
word 2:	Symbolic location or blank (05)
word 3:	
bits 1-6	Blank (05)
7-24	Operation code
25-36	Blank (05)
word 4:	
bits 1-12	Blank (05)
13-36	1st four characters of variable field
word 5 to 13:	Remaining characters of variable field, followed by remarks if any (6 characters/word)
word 14:	
bits 1-12	Final 2 characters of variable field
13-24	Binary card count
25-36	Identification code-fieldata BB

Note: First double 05 specifies termination of variable field.

4.3.5.5.2 None

A. Table name - Symbol Table

B. Table symbol - None assigned, core contained "Own Code".

C. No. of words/entry - 2

D. No. of entries - 1800 maximum, dependent upon number of instructions with symbolic locations.

E. Table function - used to convert "Own Code" instructions to CAP instructions

F. Table format

word 1:	Symbolic name in FIELDATA, right justified. Master space fill at left end (00).
word 2:	Relative line count of symbolic name.

4.3.5.5.3 PS1N

A. Table name - Pseudo-CAP

B. Table symbol - PS1N, assigned by Run 1.4A

C. No. of words/entry - dependent upon size of variable field

D. No. of entries - one for each "Own Code" instruction

E. Table function - intermediate output of "Own Code" to CAP translation process

F. Table format

word 1:

bits 1-3	CAP type { = 0, internal instruction = 1, pseudo-op instruction
4-9	Machine instruction
10-11, 13	Part number { = 001 A portion = 010 M portion = 100 I portion
12	Statement bit
14-36	zero

word 2: zero

word 3:

bits 1-12	Card count
13-36	First four characters of variable field
words 4 to N:	Remaining characters of variable field (6 characters/word)

4.3.5.5.4 OC1N

A. Table Name - Own Code Generator Call

B. Table Symbol - OC1N set by Run 1.4A

C. No. of words/entry - 3 or 4

D. No. of entries - variable

E. Table function - processed through the MOBILE system, resulting in CAP input to Run 8.

F. Table format

word 1: Generator call header

bits 1-9	Generator name
10-19	Block number (for ordering of calls)
20-27	Number of entries
28-36	Item size

word 2: Generator call header

bits 1-21	zero
22-36	OISN

word 3: Literal Name

bits 1-3	Literal name key (011)
4-11	Zero
12-13	Number of words (10)
14-36	Zero

word 4: CAP

bits 1-3	CAP type { = 0, internal instruction = 1, pseudo-op instruction
4-9	Machine instruction
10-11, 13	Part number { = 001 A portion = 010 M portion = 100 I portion

	12	Statement bit
	14	Zero
	15	Decrement bit { = 0, increment; = 1, decrement
	16-36	Address portion
word 5:		CAP
bits	1-15	CAP symbol
	16-36	Index-modifier portion
word 6:		Location word
bits	1- 3	Location word key (000)
	4-12	Jump word
	13-19	zero
	20-24	DDT memory load number
	25-36	DDT relative address

Note: The above format of words 3 to 6 constitutes the internal equivalent of a reference in "Own code" to a data name in Working Storage.

Words 3 to 5 are sufficient for a reference to a symbolic location within this ENTER USAGE.

The appropriate format is repeated for each entry within the generator call.

4.3.5.6 Instruction Field Interpretation

The field interpretations are as follows:

A = Address field

I = Index field

M = Modifier field

( ) = May be coded but not required

N = Octal integer

Each "Own code" instruction results in a two word CAP of which only the first word is given in the octal equivalent form. The second word is zero.

4.3.5.6.1 Group 1 – Internal Instructions

Title	Field Interpretation	CAP Equivalent
ADB	A, (I), M	02 40000 00000
ADD	A, (I), M	01 20000 00000
ADM	A, (I), M	01 30000 00000
CAM	A, (I)	01 10000 00000
CLA	A, (I)	01 00000 00000
CLS	A, (I)	01 40000 00000
CSM	A, (I)	01 50000 00000
CYL	A, (I)	03 50000 00000
CYS	A, (I)	03 40000 00000
DVD	A, (I), M	02 20000 00000
DVL	A, (I), M	02 30000 00000
HLT	(A), (I), (M)	00 00000 00000
LGA	A, (I)	00 30000 00000
LGM	A, (I)	00 20000 00000
LGN	A, (I)	00 40000 00000
LOD	A, (I), M	05 10000 00000
LXS	A, (I)	05 30000 00000
MLR	A, (I)	02 10000 00000
MLY	A, (I)	02 00000 00000
MOV	A, (I), M	05 20000 00000
MSK	A, (I)	05 50000 00000
NRM	A, (I)	03 70000 00000
RPA	A, (I)	05 40000 00000
RPT	A, (I), M	00 10000 00000
SBB	A, (I), M	02 50000 00000
SBM	A, (I), M	01 70000 00000
SEN	A, (I), M	00 50000 00000
SHL	A, (I), M	03 00000 00000
SHR	A, (I)	03 20000 00000
SLL	A, (I), M	03 10000 00000
SNR	A, (I), M	00 70000 00000
SNS	A, (I), M	00 60000 00000

Title	Field Interpretation	CAP Equivalent
SRL	A, (I)	03 30000 00000
STR	A, (I)	05 00000 00000
SUB	A, (I), M	01 60000 00000
TRC	A, (I)	04 70000 00000
TRL	A, (I), (M)	04 10000 00000
TRN	A, (I)	04 60000 00000
TRP	A, (I)	04 40000 00000
TRS		04 20000 00000
TRU	A, (I), (M)	04 00000 00000
TRX	A, I, M	04 30000 00000
TRZ	A, (I)	04 50000 00000

4.3.5.6.2 Group 2 – Instructions

Title	Field Interpretation	CAP Equivalent
BES	N	10 10000 00000
BSS	N	10 20000 00000
OCT	±N	10 30000 00000
PZE	A, I-M	10 50000 00000
MZE	A, I-M	10 60000 00000
REM		IGNORED
END		IGNORED

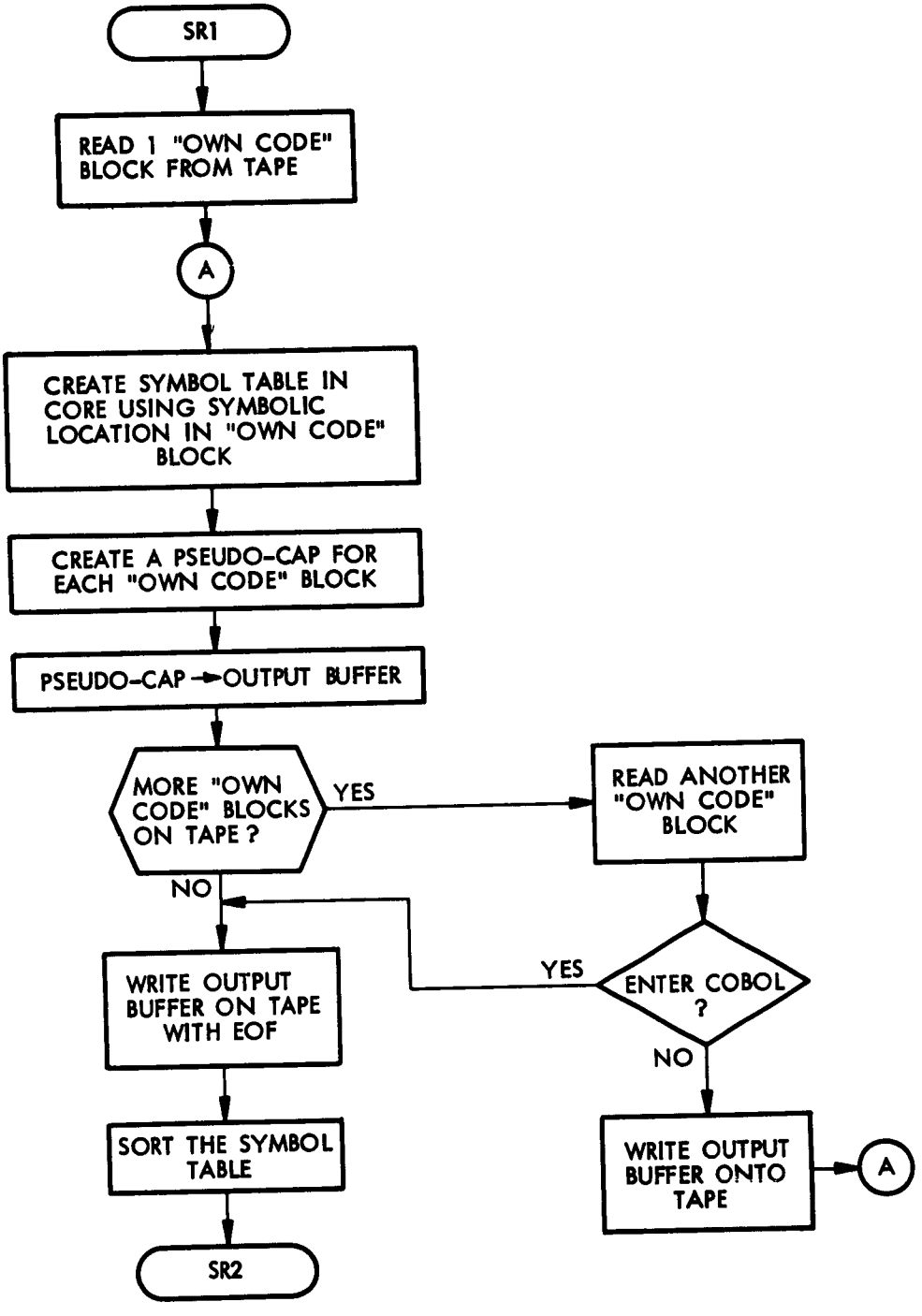

Figure 4-3. Own Code (Pass I)

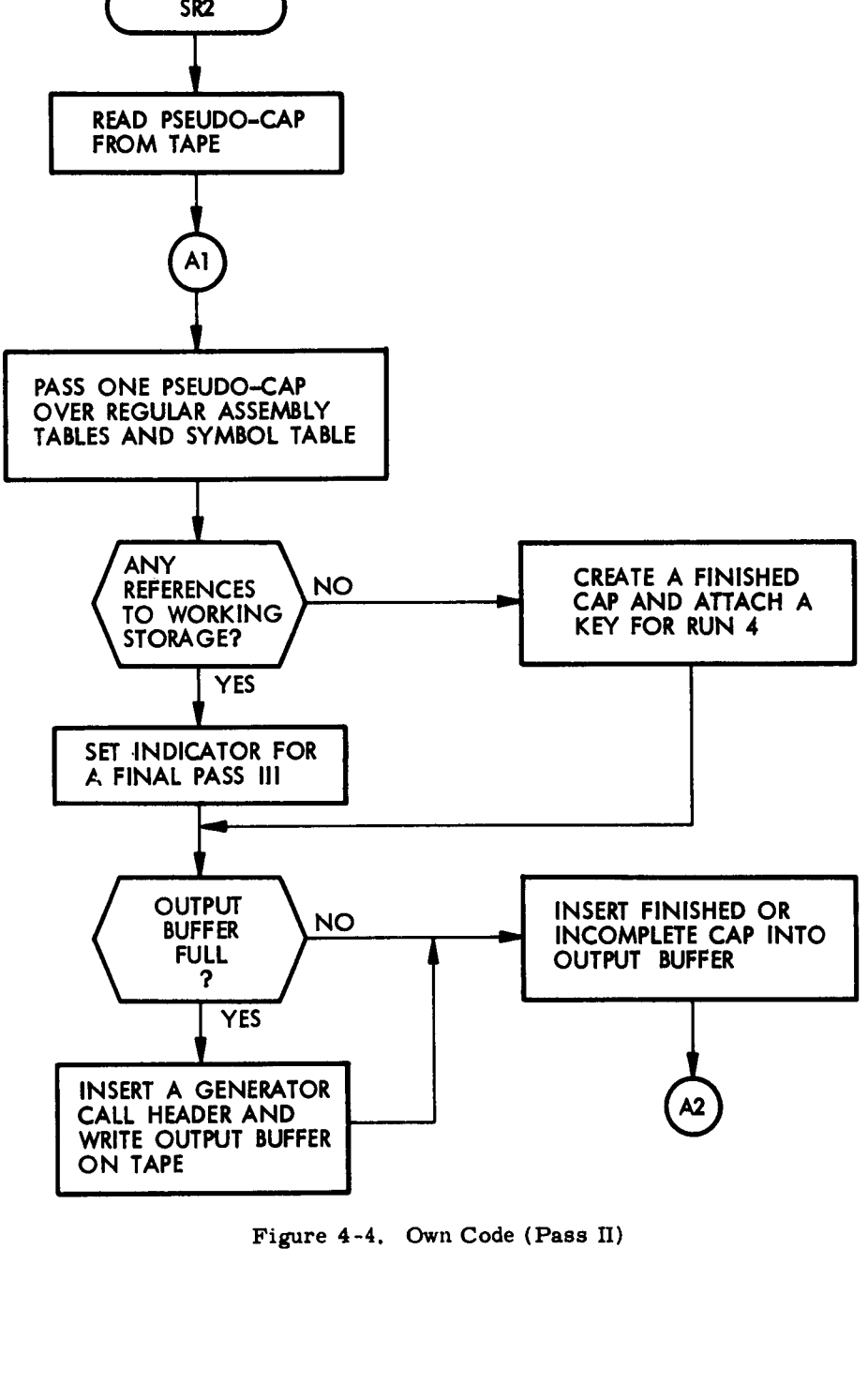

Figure 4-4. Own Code (Pass II)

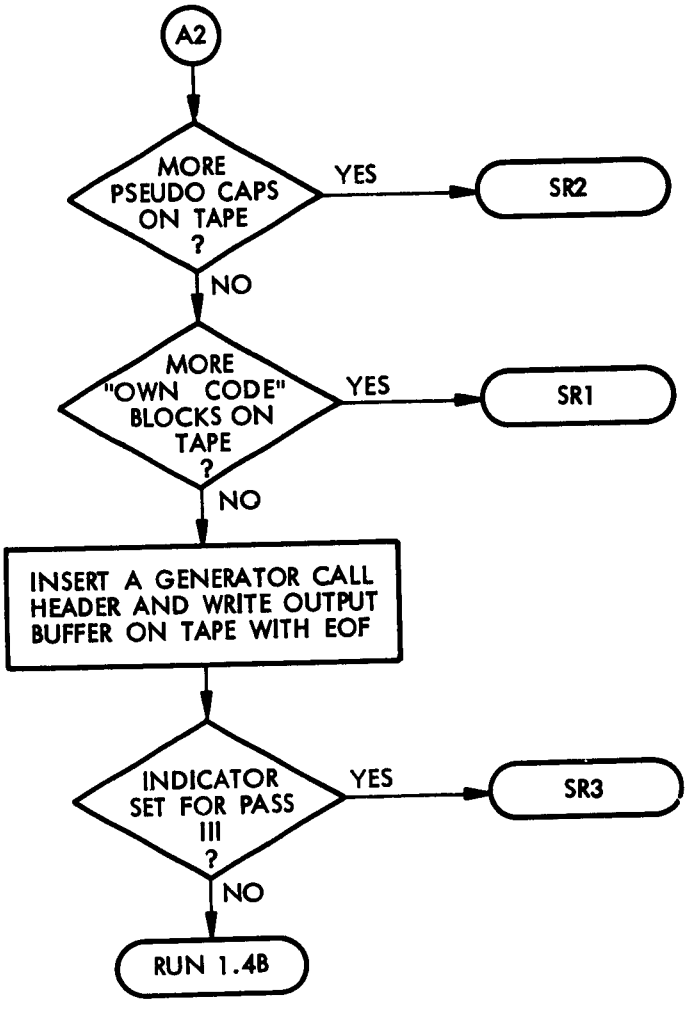

Figure 4-4. Own Code (Pass II) (Cont.)

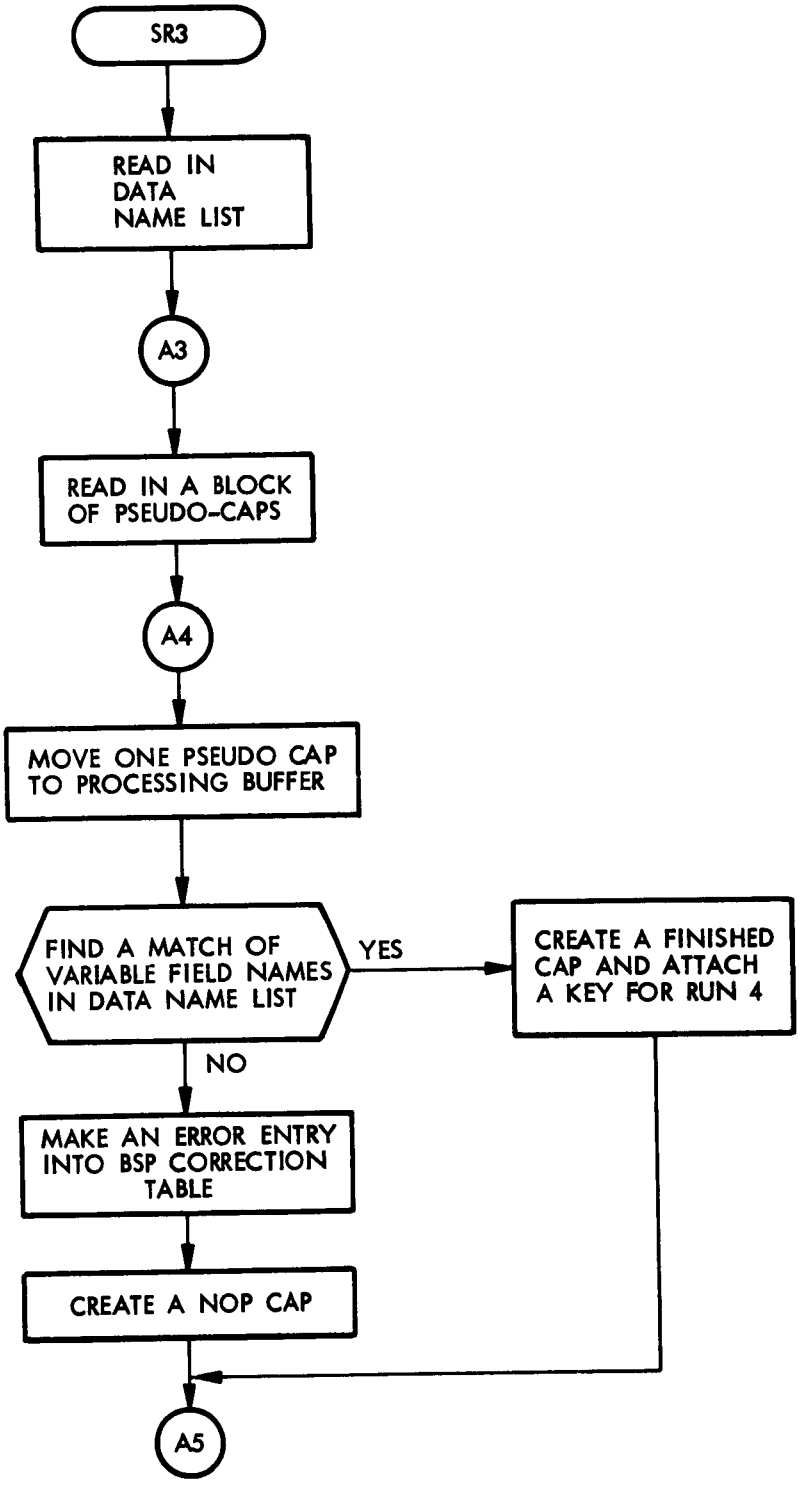

Figure 4-5. Own Code (Pass III)

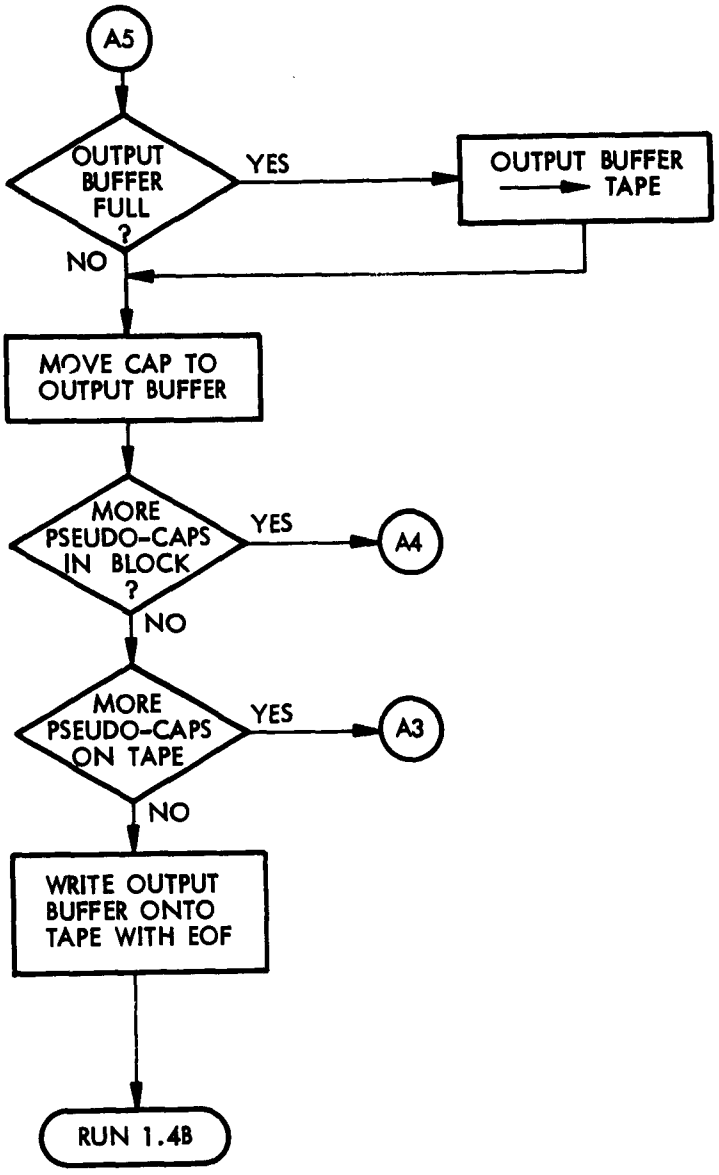

Figure 4-5. Own Code (Pass III) (Cont.)

4.3.6 Run 2 Modifications

4.3.6.1 Former Function

The primary function of Run 2 is twofold, sorting and merging. Minor editing is also done at this time. Associated with each generator call produced by Run 1.3 is a generator number. These generator numbers are serial numbers assigned to each generator. The sort that occurs in Run 2 uses this generator number as a key to arrange the generator calls such that all calls for the same generator occur simultaneously, and prior to the next generator.

4.3.6.2 Modified Function and Internal Sort Description

A major change has taken place in the use of an internal sort to replace the "binary" sort. Each compressed generator call has an entry in a control table. This table gives the size of the compressed generator call and its starting location in core at the time of sorting. By using the "internal" or "in place" sort, the buffer used by this control table during sorting is being halved. After the control table has been formed, any editing to be done is performed at this time. In the internal sort, while the table is being examined and the compressed generator call with the lowest serial number is being found, an exchange is made between the first table entry and the entry for the generator call with the lowest serial number. The generator with the lowest serial number is then moved to the output buffer. Each time this output buffer is filled, (approximately 600 generator calls) it is written on the appropriate tape. Tape 5 is the tape in this case. The size of the table is decreased by one. The next lowest serial number is found, and its entry exchanges places with the second table entry. This process continues in this manner until the control table is completely sorted.

Another major change is in the size of the input buffer which has been reduced considerably because of the decrease in available storage area. It is expected that there will be no more than two buffer loads of the size now available. In this case, it was necessary to add another phase to Run 2, namely, the merge phase. This is not a separate section of Run 2 but an integrated part of Run 2 Coding. If Run 2 control finds that the amount of information on Tape 5 will overflow the input buffer, an indicator is set, and the same internal sort explained

above takes place on one buffer load. This sorted information is now written as a string on Tape 6. Then the remaining generator calls are read into the input buffer and a control table is set up for them.

The size of the table is increased by one. Before sorting the control table, a block of Tape 6 is read into a separate area. (This block contains the first string of sorted information mentioned previously). For the first generator call from that block, a negative table entry is made to the control table. A pass through the sort is made and the lowest entry is found.

If this is a positive entry, an exchange is made, the table size is decreased by one, the compressed generator call is moved to be written on Tape 5, and a return is made for another pass of the sort. If this is a negative entry, an exchange is made; the table size is not decreased by one; that the compressed generator call is moved to be written on Tape 5; a new negative entry is made from the string on Tape 6 and takes the place in the table of the previous negative table entry; and a return is made to the sort phase. When there are no more positive entries or compressed generator calls from Tape 6, the last buffer load is written out with the WRITE END OF FILE (WEF) set.

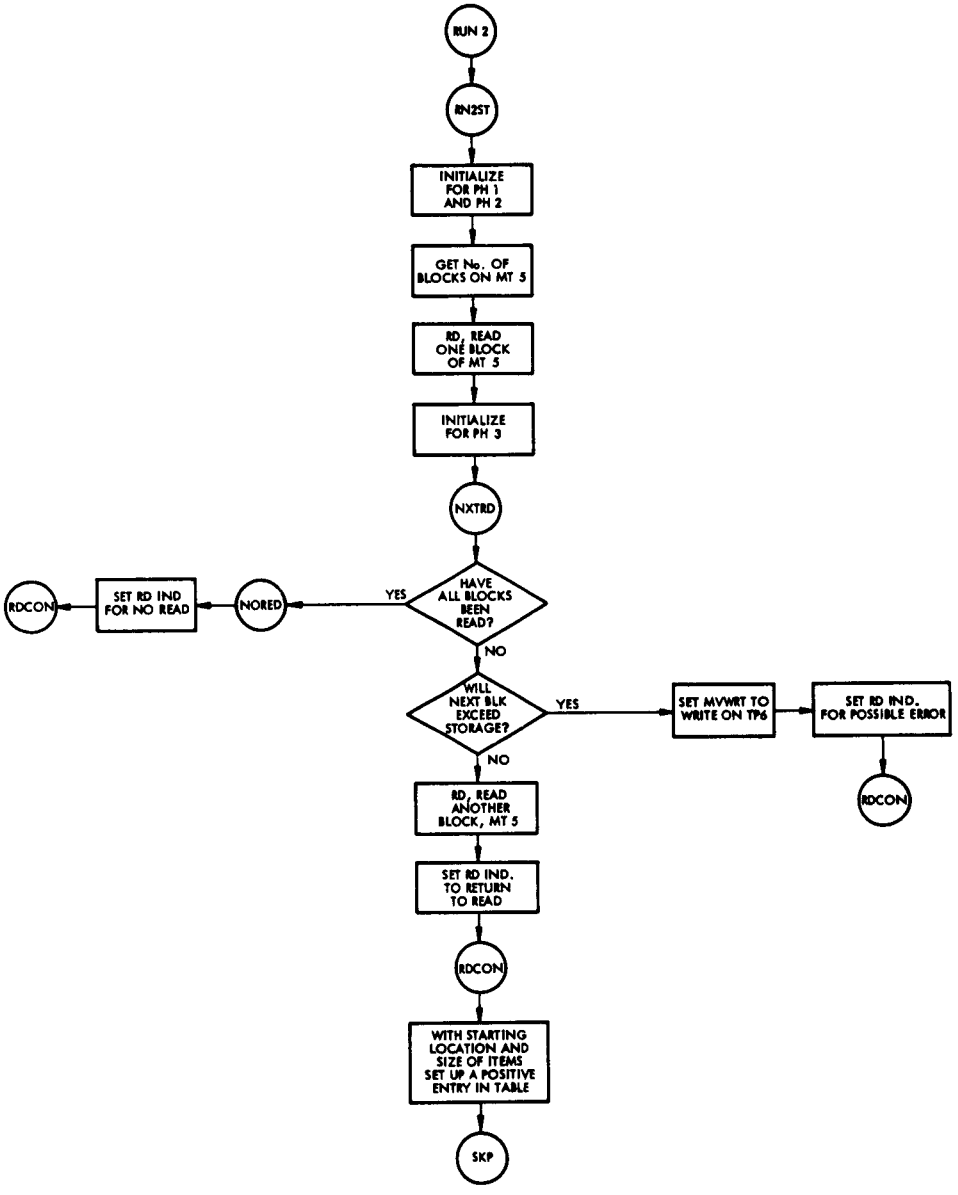

Figure 4-6. Internal Sort Flowchart

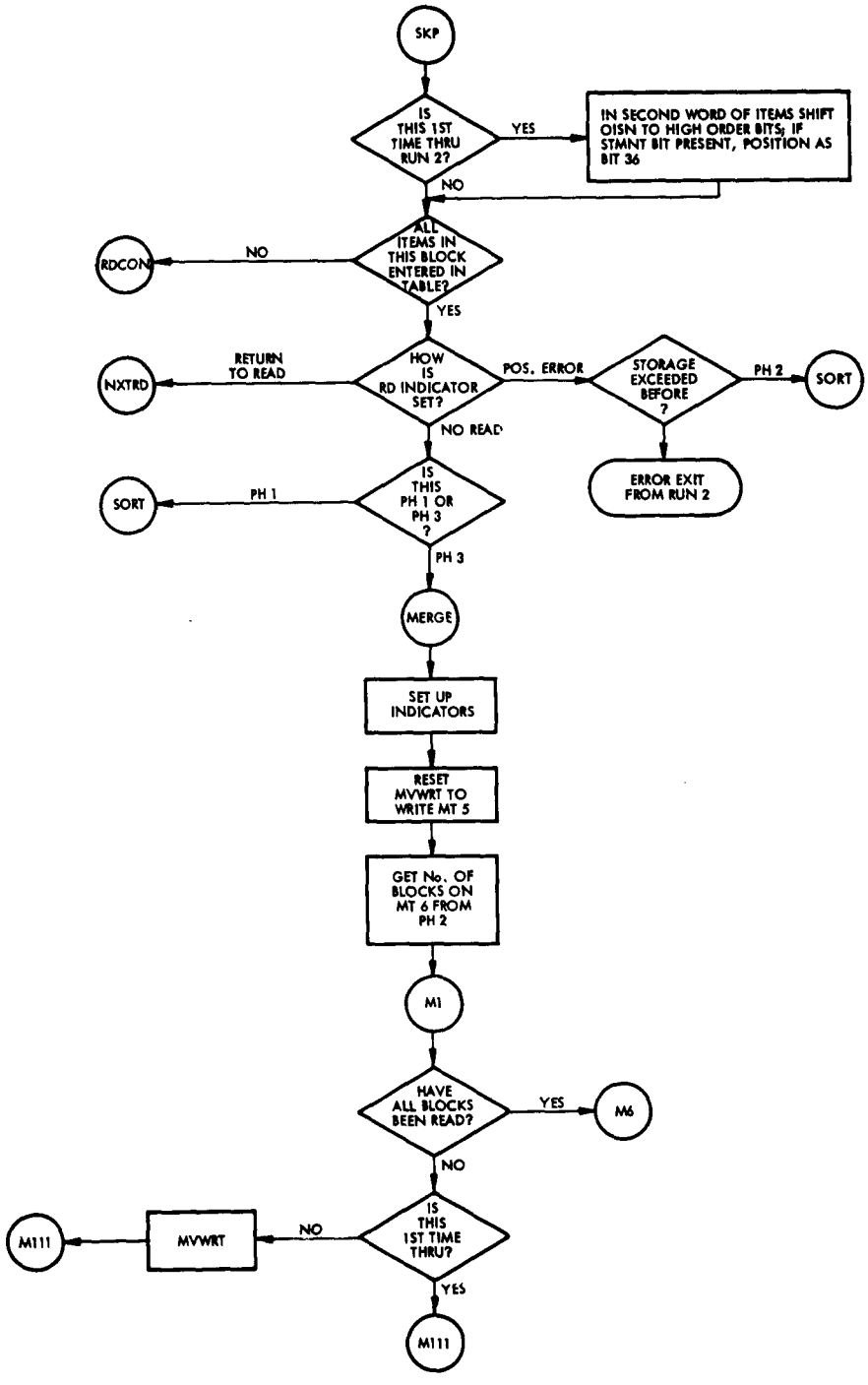

Figure 4-6. Internal Sort Flowchart (Cont.)

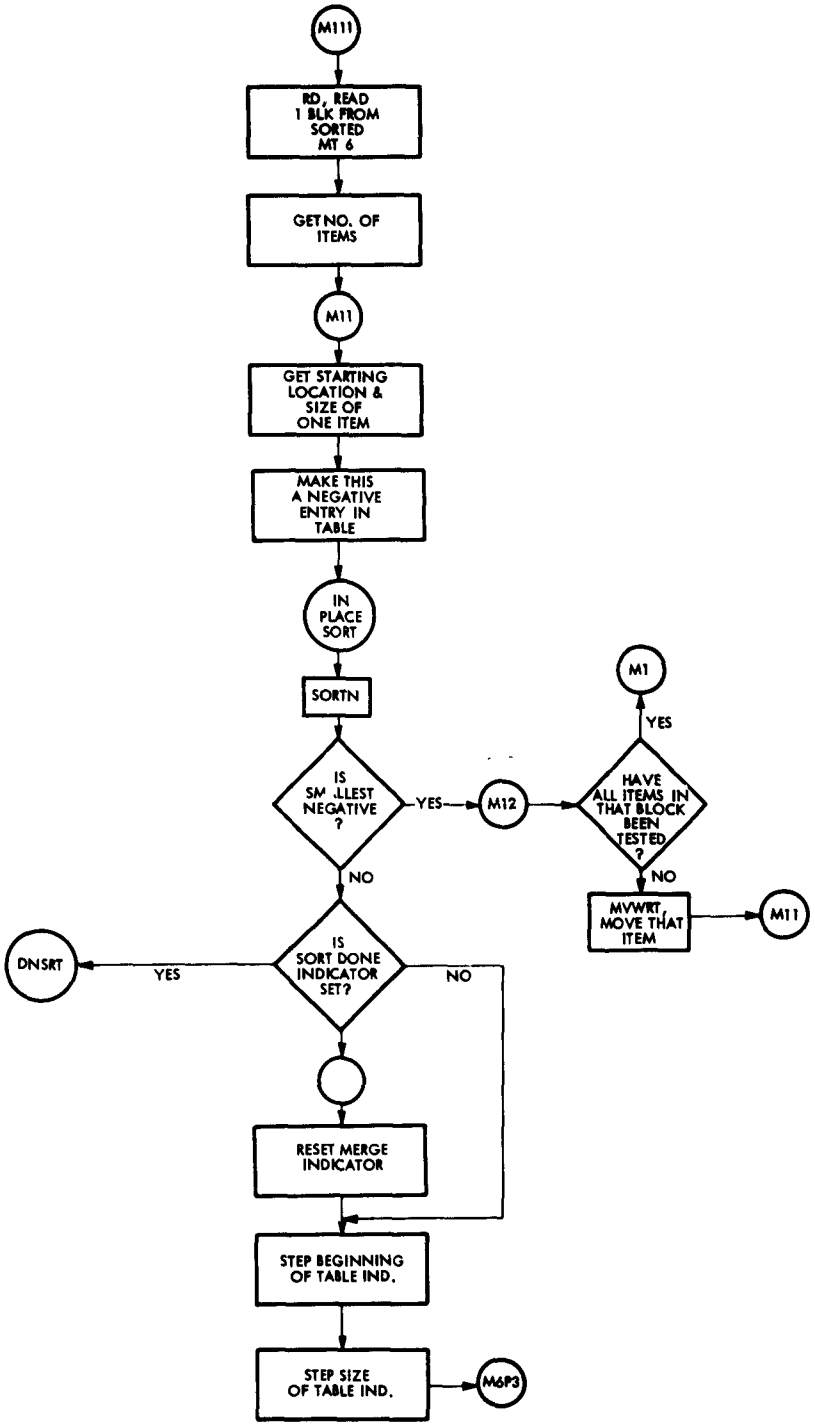

Figure 4-6. Internal Sort Flowchart (Cont.)

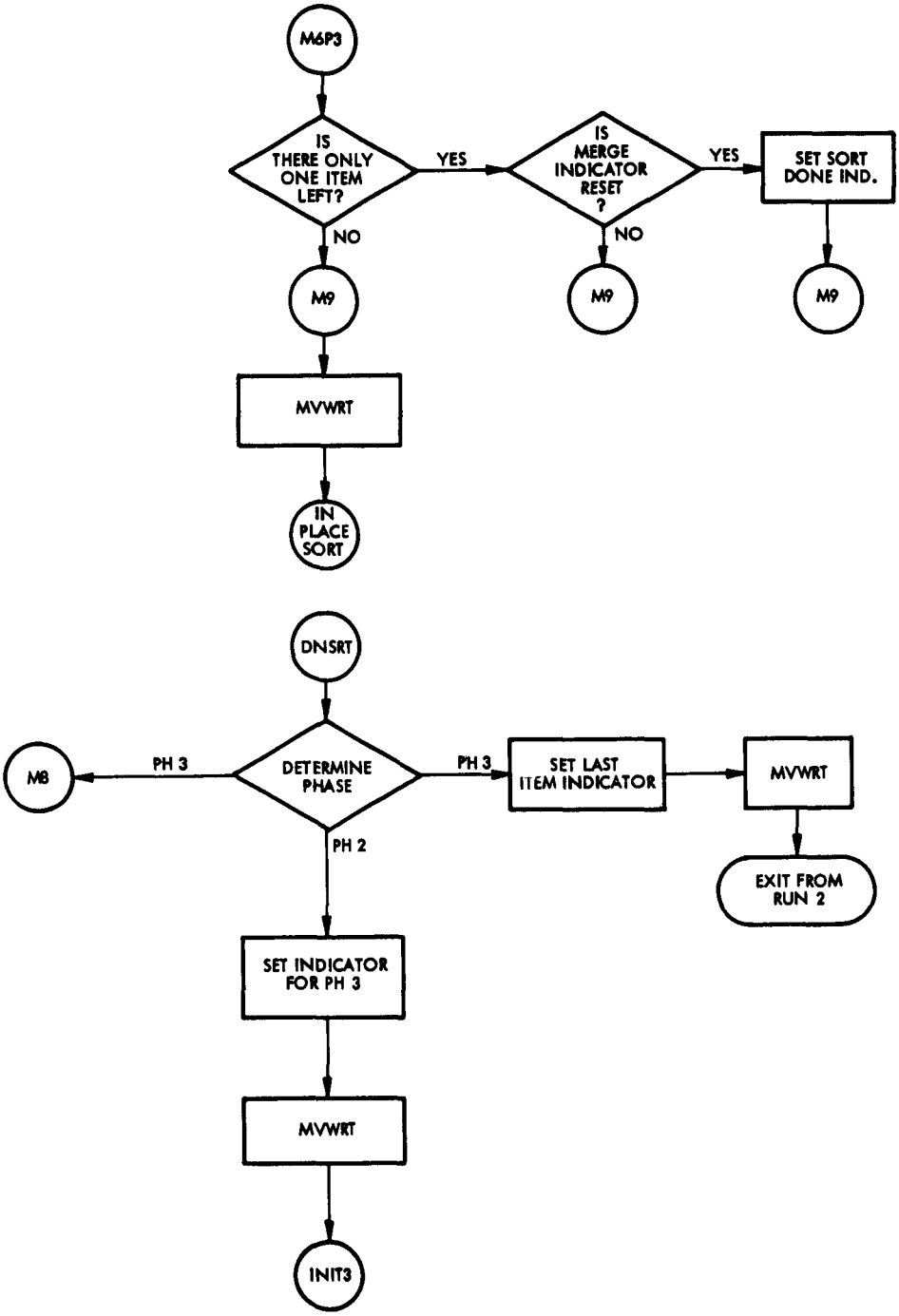

Figure 4-6. Internal Sort Flowchart (Cont.)

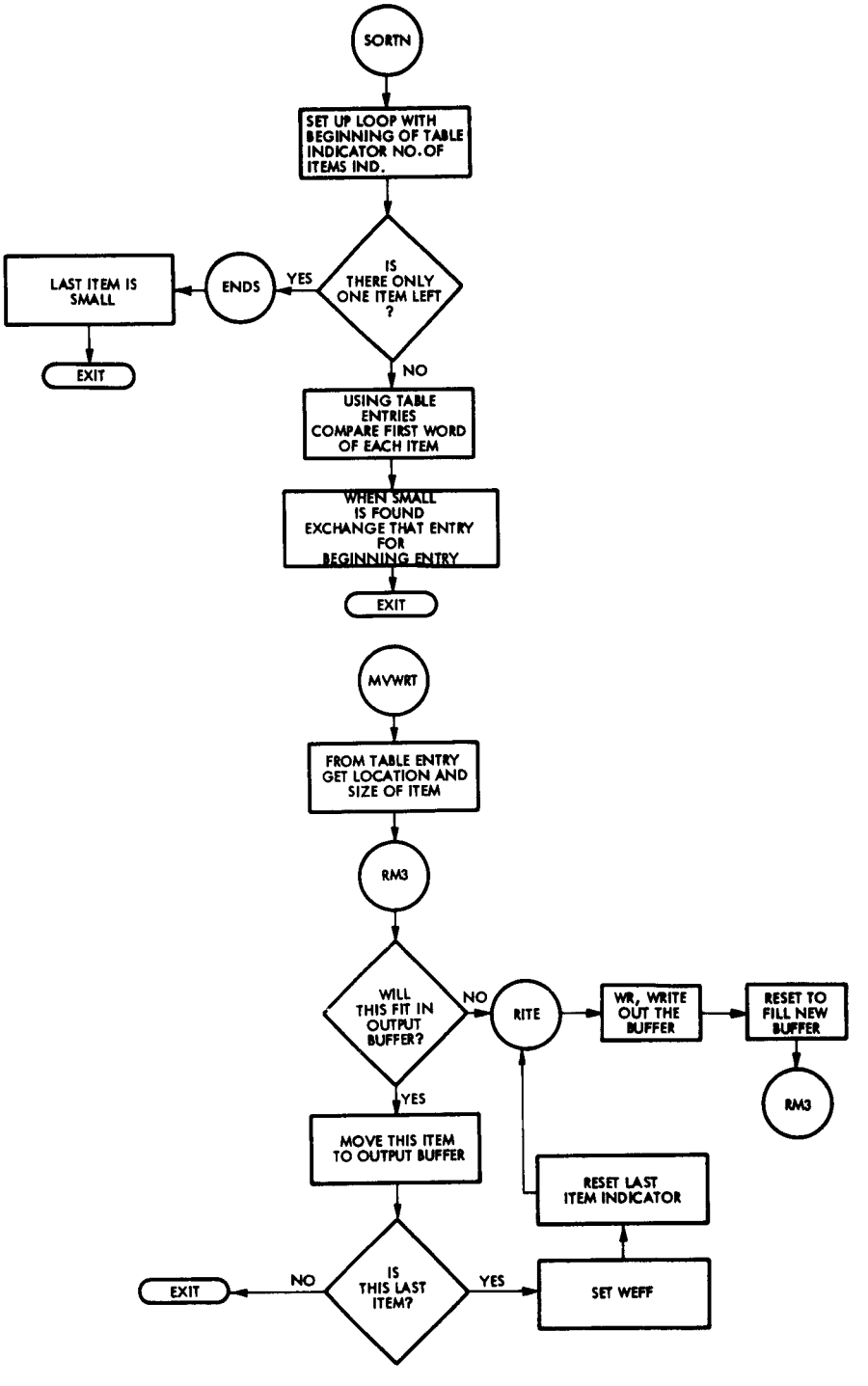

Figure 4-6. Internal Sort Flowchart (Cont.)

4.3.7 Run 4 Modifications

Run 4 appends data replies to compressed generator calls produced by Run 1.3, thus forming complete generator calls. In addition, certain concomitant functions are performed, including making entries to the Data Analyzer Table for each appended data reply.

The 9400 version of Run 4 has been modified to accommodate the core memory capacity of the MOBIDIC Computer. The modification consists of reducing the size of certain buffer areas of core; replacing the "double" buffer technique by a "single" buffer technique for reading in and processing the compressed generator calls.

4.3.8 Run 3 Modifications

4.3.8.1 Run 3 Service Routines

4.3.8.1.1 Purpose

The main function of Run 3 is to read the generators into core, one at a time, feed the calls to the generators, one at a time, and accept output from the generators.

4.3.8.1.2 Input

1. Generator Calls – Variable length entries produced by Run 1.3 in response to verbs in the Source Program. They are sorted by generator name and have all necessary data replies appended to them.
2. File Description Table – Produced by Run 1.2 for the I/O Generator. It contains information from the Environment and Data Division concerning the files that have been selected by the Source Program.
3. Address Variable Table – Produced by Run 4 and contains a list of data-name subscripts in which changes to subscript values may be noted.
4. File Table – Used by the I/O Generator and contains a one-word entry for each file selected by the source programmer. It also contains information from the Procedure Division regarding the file's use as input and output.
5. Control Block – Contains information from the Environment Division about the source and object computers.

4.3.8.1.3 Method

Run 3 has a table in core to guide it in the selection of generators to process the generator calls. This table has a one word entry for each existing generator. A marker is inserted in this table to indicate which generators are required to process the Source Program input. Run 3 also adds markers for generators required to process one cycle and two cycle calls.

The communication between Run 3 and the generators is identical for all generators. Run 3 transfers to the generator from a calling sequence which resembles:

A	TRL	X	GO TO GENERATOR
A+1	HLT		INPUT ADDRESS
A+2	HLT		OUTPUT ADDRESS
A+3			RETURN LOCATION

"X" is the first location in each generator. The initial entrance to each generator comes at X.

When a generator wishes to return to Run 3, it transfers (with a TRL) to A+3. If the generator is returning to Run 3 in order to pass on some output, it must first place the starting address of the output in A+2. For each transfer to A+3 the generator must have previously loaded an indicator number into Index Register 4 to tell Run 3 what the output is. If a new generator call or a new generator segment (I/O gen. only) is indicated, Run 3 will return to X. In the case of a new generator call, the absolute address of the call will be in X+1. In all other cases, Run 3 will return by the equivalent of a TRS instruction. In Table 4-1 is a list of the codes, return addresses and other information required in communication with Run 3.

TABLE 4-1. INFORMATION REQUIRED in COMMUNICATION WITH RUN 3

Octal Code NO. in IR4	Return Address	Reason for Return Run 3
0	C(PCS)	XFISN table entry (7)
1	C(PCS)	Constant table entry (1) (2)
2	C(PCS)	Subroutine call (2)
3	C(PCS)	Alter table entry (1) (2) (7)
4	C(PCS)	Link table entry (2)
5	C(PCS)	Tape data table (2) (6)
6	C(PCS)	Macro entry (2)
7	C(PCS)	File requirement table entry (2) (6)

TABLE 4-1. INFORMATION REQUIRED
IN COMMUNICATION WITH RUN 3 (Cont.)

Octal Code No. in IR4	Return Address	Reason for Return Run 3
10	C(PCS)	File data block (2) (6)
11	C(PCS)	One cycle generator call (2)
12	C(PCS)	Complete generator call (2) (7)
13	C(PCS)	Junk Storage count (3) (7)
14	C(PCS)	Multiple file data table (2) (6)
15	C(PCS)	Special storage count (3) (7)
16	"X"	Exit for new generator call (4)
17	"X"	Exit for new segment (5) (6)
20	C(PCS)	Two cycle call (2) (7)

(1) Constant or alter serial number which has been assigned by Run 3 will be in the accumulator on return to the generator.

(2) Starting address of output item must be in A+2 when entering Run 3.

(3) A+2 contains the absolute number of locations required by the generator, to be reserved in core during object running time for storage purposes.

(4) When all generator calls have been processed this exit will cause Run 3 to read in the next required generator.

(5) The desired segment must be indicated by putting a binary key in A+2.

(6) Used only by I/O Generator.

(7) Used only by non I/O Generators.

4.3.8.1.4 Output

1. Batch Generator Output – Contains macros and entries to five tables:

   a. XFISN
   b. Constant
   c. Subroutine call
   d. Alter
   e. Link

This output is sorted by Run 5.

2. Tape Data Table – Produced by the I/O generator and is used at object running time to keep track of tape usage by all files.

3. File Requirement Table – Produced by the I/O generator and contains information used by Run 7 to set aside proper buffer space in the Object Program for each file selected.

4. File Data Block – Produced by the I/O generator and is used by the object I/O coding in keeping track of the usage of the files selected in the Source Program.

5. One Cycle Calls – Calls on a following generator which are saved by Run 3 until the required generator is in core.

6. Complete Generator Call – Calls which must be recycled to Run 2 for resorting and through Run 4 for data replies.

7. Multiple File Data Table – Produced by the I/O Generator and is used by the object I/O coding in keeping track of the usage of multiple file tape if any were given in the Source Program.

8. Two Cycle Calls – Calls on a following generator which are saved by Run 3 until the required generator is in core. Calls for this group of generators can only be produced by other generators and not by any verb in the Source Program.

This describes the basic design of Run 3 for the MOBIDIC Computer. The required changes of Run 3 of the 9400 MOBILE I have been made.

4.3.8.2 Input-Output Generator

4.3.8.2.1 Purpose

The task of the generator is to inspect those parts of the Source Program relating to input-output operations and to take the action necessary to insure that these operations will be performed in the Object Program. The Source Program is available to the generator in the form of compiler tables and the generator only indirectly produces the actual coding of the Object Program by creating more internal table entries. These table entries cause later runs to generate the proper machine coding.

4.3.8.2.2 Input

All the inputs to the generator are supplied by the Run 3 control program. With the exception of the input-output generator calls, all inputs are already available in core memory when the generator is first entered. Inputs are as follows:

1. File Description Table – This table contains information from the Environment and Data Divisions of the Source Program concerning the files that have been selected by the source programmer.
2. File Table – This table is made up of one word entries for each file "selected" by the source programmer and contains information from the Procedure Division regarding the file's use as input and output.
3. Multiple File Table – This table contains one entry for each "Multiple File Tape Contains..." statement in the Environment Division of the Source Program.
4. Control Block – This table contains information from the Environment Division about the source and object computers.
5. Compressed Generator Calls – These are variable length entries produced by Run 1.3 in response to I/O verbs in the Source Program. They are sorted in a special order and released to the generator, one at a time, by the Run 3 control program.

4.3.8.2.3 Output

Outputs from the generator are all passed on to the Run 3 control program via a calling sequence. They consist of one to three binary tables and various internal table entries. The binary tables are to be placed into the Object Program with no alteration. The various internal table entries will be used by later runs to generate object coding and reserve the proper input-output buffer areas. Outputs are as follows:

1. TAPDAT Table – A table that will be used by the object I/O coding in keeping track of tape usage by all files.

2. MFRDAT Table – A table that will be used by the object I/O coding in keeping track of the usage of multiple file tapes if any were given in the Source Program.

3. FILDAT Table – A table that will be used by the object I/O coding in keeping track of the usage of the actual files selected in the Source Program.

4. File Requirement Table – A table used by Run 7 to set aside the proper buffer space in the Object Program for each file selected.

5. Subroutine Calls – Variable length entries made to a table used by Run 6 to initiate the process by which precoded subroutines will appear in the object coding.

6. Macros – Variable length entries made to a table used by Run 6 to initiate the process by which precoded instructions will appear in the object coding.

7. One Cycle Generator Calls – Variable length entries made to a table used by later (non I/O) generators, to produce coding not directly associated with input-output.

8. Link Table Entries – Fixed length entries made to a table used by Run 6 in its optimization of the object coding.

9. Constant Table Entries – Fixed length entries made to a table used by Run 6 to generate a constant "pool" in the object coding.

4.3.8.2.4 Input-Output Generator Segments

Due to the size of the tables required by the generator, it has been necessary to divide it into five sections, each of which will overlay the previous one. There is no need for recycling, since each section is used once and only once.

Communication with Run 3 control is the same in all five sections and through use of the prescribed calling sequence all five sections of the generator will be entered at their first location.

All five sections have a short section of initialization coding which prepares the section for communication with Run 3 control, and all five sections

have a short subroutine which does the actual transfer of control to Run 3. This eliminates the problem of initializing many locations and provides a uniform procedure for all transfers. Likewise, all five sections of the generator have a small control section which enters the various tasks of the section in a prescribed order, making each section modular and more easily alterable.

4.3.8.2.5 Description of the Five Segments of I/O Generator

Segment 1

Segment 1 does not process any generator calls but merely creates certain tables and does some preliminary work on the File Description Table. Tasks performed are as follows:

1. Assigns tape units to all files, checking for discrepancies.
2. Creates a TAPDAT table for Object Program.
3. Creates a MFRDAT table for Object Program if multiple file reel(s) are present.
4. Reduces all sizes of data in the File Description Table to words and computes sizes of desired buffer areas, current record areas, etc., altering the File Description Table in so doing.
5. Creates a File Requirement Table for Run 7.
6. Further alters the File Description Table by reducing label record information.

Segment 2

Segment 2 processes all the I/O generator calls, and produces all the macros for the object coding, but does not produce any subroutine calls. All other output used in later runs is produced in Segment 2. Tasks performed are as follows:

1. Processes USE generator calls and constructs a table of USE FISNS associated with label record USE procedures.
2. Processes USE generator calls and constructs a table of USE FISNS associated with error USE procedures.
3. Processes OPEN INPUT, READ, OPEN OUTPUT, WRITE and CLOSE generator calls, producing a macro for each call and placing the

names of the desired skeleton subroutines in a table to be passed on to Segment 3.1.

4. Produces constant table entries where needed in macros.

5. Produces link table entries for all READ macros that have a conditional fall through and a jump to another FISN.

6. Produces one cycle, special PERFORM generator calls to duplicate AT END procedures where they are not stated.

7. Produces one cycle, special MOVE generator calls to isolate value of data-name in the WRITE record-name AFTER/BEFORE ADVANCING data-name LINES.

8. Sets a special list in that file's File Description Table entry if any file has a CLOSE File-name WITH LOCK statement.

Segment 3

Segment 3 produces subroutine calls only. Segment 3 uses the table of subroutine names passed on from Segment 2 and produces a subroutine call for each such subroutine name. Segment 3 has been further segmented in the following manner:

Segment 3.1 processes the table of subroutine names passed on from Segment 2 and produces a temporary subroutine call. This temporary subroutine call includes all the necessary deletion words and the fixed header only. Segment 3.1 also produces a temporary subroutine call for all other subroutines required by the subroutine originally requested by Segment 2. It is also the task of Segment 3.1 to insure that only those subroutines designated "duplicatable" will appear more than once in the Object Program. The temporary subroutine calls are passed on to Segment 3.2

Segment 3.2 fills out the temporary subroutine call provided by Segment 3.1. Operands necessary for the subroutine being requested are appended to the temporary subroutine call and the resultant subroutine call is given to Run 3 control to be passed on to Run 6.

Segment 4

Segment 4 produces the File Data Table only, from information in the File Description Table.

4.3.8.3 Modification of the Non I/O Generators

The generators listed below have been modified for the MOBIDIC Computer: MOVE ALL, SIMPLE PERFORM, ALTER, GO TO, EXAMINE, COMPLEX PERFORM, STOP and EXIT. Included below is a description of the implementation of the ACCEPT and DISPLAY Generators for the MOBIDIC Compiler.

4.3.8.3.1 The ACCEPT Generator

ACCEPT data-name FROM device-name.

4.3.8.3.1.1 Purpose

The ACCEPT generator processes the equivalent of a single ACCEPT statement in the Source Program and determines the type of object code needed to perform the input operations.

4.3.8.3.1.2 Input

The generator processes a single generator call one at a time. The body of the call consists of the location word of the receiving area, an encoded keyword corresponding to the devices (if the "device-name" clause is present), and a complete description of the receiving area.

4.3.8.3.1.3 Method (Object Code Subroutine Used)

All input-output orders will be executed by use of the Input-output subroutines which are inserted into the Object Program by the I/O Generator. The Input-output routines are always entered at subroutine AUXSD1. In addition, the ACCEPT generator may insert one of the following subroutines:

ACCPT 1

The ACCPT 1 subroutine initializes calling sequence to AUXSD1, and delays return until Input-output indicates the release of the input data.

ACCPT 2

The ACCPT 2 subroutine double-buffers reads of Hollerith cards, converts the cards into FIELDATA and assembles data in the indicated receiving area.

Both of these subroutines have the same calling sequence. The TRL loads the count for acceptance to IR4. The word following the TRL contains the input instruction with a sign mode indicator (ISN or NISN). In order to produce a MACRO CALL for this calling sequence, the following information has to be extracted from the generator call: Device Address (D), Count (C), Sign Mode (M), Receiving Address (A), Instruction Code (I) and Subroutine (S).

4.3.8.3.1.4 Generator Processing

A. The data description of the receiving area is tested for the following conditions.

1) If the data unit is synchronized.

2) If the starting bit is equal to zero and the size is a multiple of 36 bits.

If either of the above conditions is true, an indicator is set (IND) indicating that to read directly into the receiving area may be possible.

B. The encoded device from the generator call is compared to a table containing the allowable devices, the actual machine address (D) of each device, and a jump to a routine which will process this device. The Word-Switch-Register (WSR) is not considered as a device.

C. Control is passed to the following process routines:

1) Word-Switch Register (WSR). A MACRO CALL is produced to supply a calling sequence, HLT, CLA and WSR. Control is then passed to the PACK subroutine (see page 4-96 of the 1st Quartly Report), to store the result.

2) Paper-Tape-Reader (PTR)

1. M is NISN

2. Base is binary, 1 = ROX (Read Octal) C = size in WORDS.
Base is FIELDATA, I = RAN (Read Alphanumeric)
C = size in characters.

3. S = ACCOT 1

4. If IND is not set, a buffer is reserved in the OPEN storage which is equal to the size of the data unit, and A is equal to the address of the buffer. If IND is set, A is equal to the address of the data unit.

3) Card-Reader (CDR)–ISN

1. M = ISN
2. I = RAN
3. C = size in cards
4. If IND is set and size is a multiple of card image, A is equal to the address of the card image, otherwise, a buffer is reserved.
5. S = ACCPT 1

4) Card-Reader (CDR)

1. If the base of the field is binary, control is passed to CDR-ISN.
2. M = NISN
3. I = RAN
4. S = ACCPT 2
5. A is determined as in subsection 4.3.8.4.1.4 C.2.
6. C = size in cards.

D. After these routines have returned control to the main line generator, the MACRO CALL for the calling sequence is produced (from A, I, S, M, C), and a subroutine call is produced for S.

E. If the data has not been accepted directly into the receiving area, control is passed to the PACK routine (see page 4-96 of the 1st Quarterly Report), to move the data from the buffer area into the correct location.

4.3.8.3.2 The DISPLAY Generator

4.3.8.3.2.1 Purpose

The DISPLAY generator resembles the ACCEPT generator in input, general construction, output, and use of the Input-output subroutines. There are two entrance points which correspond to the DSPLAY and STOP statements.

DISPLAY Entrance Point.

Object Code Subroutines Used

1. ACCPT 1
2. DSPLY 1

   The DSPLY routine is a general double-buffered card punch routine which assembles card images in binary in a card buffer, converts them to Hollerith (if needed), and transfers control to I/O for execution of the instruction. The calling sequence for this routine is a TRL, with the number of items to be displayed, loaded in Index Register 4, and followed by one word for each item, containing the address and size of that item. The size is in bits. Two entrance points are associated with this routine, for either binary or Hollerith.

4.3.8.3.2.2 Method

The encoded device from the generator call is compared to a table of allowable devices. Control is transferred to the following devices for special processing.

Accumulator – By use of the ISOLATE subroutine, MACRO CALL will be produced to unpack the single item into the accumulator. This will be followed by a HLT MACRO CALL. If the single item is an integer literal, it will be converted to binary and entered into the constant table.

Line-Printer or Flexowriter – The object code will make use of the subroutine ACCPT 1. If any item is packed at object running time, in order to be displayed directly on the device, a buffer area is reserved the size of which is equal to the item. MACRO CALLS will be produced by ISOLATE to cause the data to be moved to the buffer, and A is set equal to the buffer address. For every item to be displayed, a calling sequence MACRO is created with the following:

I = WOK (Write Octal) if base is binary.

I = WAN (Write Alphanumeric) if base is FIELDATA.

C = size in words.

M = NISN

A final calling sequence will be requested which will write out a carriage return. Literals are entered into the constant table in FIELDATA.

Paper-Tape-Punch—The processing is the same as the Flexowriter and the Line-Printer, with no final carriage return.

Card-Punch-ISN—The DSPLY subroutine will be used by the object code. This subroutine enters at the binary punch entrance point. As in FLX, a buffer is used as DISPLAY address for an item which cannot be displayed directly. One word is included in the calling sequence for every item containing the address and the size of the item. Literals are converted to binary and are entered into the constant table.

Card-Punch-NISN—The processing is the same as CARD-PUNCH-ISN except that if the base of the field to be displayed is FIELDATA, the object subroutine will be entered at the Hollerith entrance point, and literals will remain in FIELDATA.

STOP: Entrance Point

The Macros needed to display the correct item are supplied by the DISPLAY section. One of the following two MACRO CALLS is then produced:

1) If RUN option, HLT TRU * - 1 sequence requested.

2) If not the RUN option a simple HLT Macro call produced.

4 3.9 Run 5 Modifications

4.3.9.1 Former Function

The primary function of Run 5 is twofold, sorting and merging. The purpose of sort-merge is to rearrange the output of the generator calls in an order that will reflect the normal sequence of the running code and the correct tabular form of certain generator output. Being sorted on their sequence numbers, the MACROS, which will be converted to CAPS by Run 6, are put back into the order prescribed in the Procedure Division. The keys for the sort will cause the entries for the various tables to be grouped together properly.

4.3.9.2 Modified Function

The major changes made for Run 5 involve the use of the internal sort, a reduction in the size of the input buffer, and the addition of a merge phase. The internal sort which replaces the "binary" sort is of the same type as that used in Run 2.

The input which is read in from Tape 4 may be an entry for any one of the following tables:

	Table	Key	Symbol	Tape for Output	Number of Output Words
1.	Data Analysis	00	TK45	3	Variable
2.	Address Function Table	02	TX45	6	2 words*
3.	Address Function Table	04	TY45	6	2 words*
4.	Address Function Table	05	TZ45	6	2 words*
5.	Constant Table	20	TC35	6	Variable
6.	XFISN Table	30	TD35	6	1 word**
7.	Alter Table	40	TF35	6	3 words
8.	Subroutine Calls***	50X	T635	6	Variable
9.	Link Table	60	TH35	6	3 words
10.	MACRO Table	70	MA35	5	Variable

*First word removed from input record

**First and third words removed from input record

***Entries from this table sorted on 9 bits; note: key written 50X.

When the control table is made up for Run 5, an added indicator will be found. This indicator will appear for each entry of a subroutine call so that the sort may be set up to sort on 9 bits instead of the first six. Each entry gives the starting address of the item to be examined. Each item is at least three words long. This has been done so that all items will be sorted on the first six bits of the first word and also all of the next two words.

Run 5 performs in a similar manner to Run 2 in that the merge phase 1 is used only when more than one input buffer load of information is to be sorted. If no merge is needed a sort is performed to find the items with the lowest serial number. If this item has the same key as the previous lowest item, the new item is moved to the output buffer. When the buffer is full, the information contained within is written out on the appropriate tape. If this item does not have the same key as the previous lowest item, then this new item is "held" until the output buffer is written with the WEF set. Then this new item is tested; its output device is inserted into the calling sequence, and its word suppression indicator is set. The suppression is done while moving the items to the output buffer.

If a merge is necessary, no word suppression indicator for the first batch of input is set, and all items are written in one file on Tape 6. The string on Tape 6 is then merged with the second batch of input, and each item is written out on the appropriate tape.

4.4 TAPE ALLOCATION AND USAGE

There have been two main areas of modification with respect to tapes in the process of producing the MOBIDIC Compiler. First, the segmentation of the runs has produced in some cases entities which must be treated as separate runs. Second, the need to accommodate a smaller memory has increased the use of tapes for storage of both the intermediate and final output. The creation of intermediate output and the consequent modifications to use scratch tapes for this output has been done in such a manner that optimum tape usage is ensured and that the problem of table spills is eliminated.

In all cases, the final output of any MOBILE Run remains as listed below.

4.4.1 Current Tape Assignments and Usage at Compilation

Figure 4-7 indicates the tape assignment for the primary input and output data of the major phases of the program. The Systems Tape, (1), containing the compiler program itself, and the Source Program Tape (2), are used solely as input tapes and therefore can be file protected against accidental writing during a compilation. One tape (3) is reserved as a general input and output tape for all intermediate tables generated by one phase of the compiler and required as input by another phase. Throughout the compilation, the remaining three tapes (4, 5, 6) are required as intermediary tapes for the processing of data. The type data contained is dependent on the particular stage of compilation. At the end of the compilation however, one tape (5) contains the Object Program and another (6) contains the compiler listing information.

Figure 4-8 shows for each run the particular manner in which tapes 4, 5, and 6 are used during a compilation. There are a few specific rules which apply.

1. All tapes are read at all times in a forward direction. Read Reverse is never required.

2. No positioning of tapes by an individual run is at any time required.

3. All listed input tapes for a run can be assumed to be rewound at start of a run.

4. All listed output tapes for a run can be assumed to be positioned correctly at the time a write request is given.

5. A scratch tape will contain only one table at any particular point in time. All scratch tapes are automatically rewound at the completion of a read or write of that table.

6. If a tape is listed as both an input tape and a scratch tape for a run, the first write request determines its use as scratch and the tape will automatically be rewound at that time.

Figure 4-9 shows by run sequence the individual tables which appear on the listed input and output tapes. The data context of Tape 3 is also shown. This is both an input and output tape for all sections of the compiler program as has been mentioned before. All data is assumed to be read from it in a forward direction and it is never necessary for an individual run to position it.

Symbol Key for Figure 4-9 and Table 4-2

n	=	tape number
Δ	=	physical beginning of tape
SS table name	=	pertinent information exists prior to particular table referenced
table name SS	=	pertinent information exists after the particular table referenced
table name/table name	=	referenced tables are adjacent on tape
}	=	tape operations could logically occur simultaneously
RD	=	Read
WR	=	Write

Table 4-2 shows by run the detailed use of tapes by sequence of operation. Except where indicated by means of } it is assumed that the previous listed tape operation has been completed prior to the start of the next. The four character table symbol required by the MOBILE I/O routine calling sequence is shown next to the tape operation. A write or read of a table as shown is not meant to indicate that the entire table can either be or not be core contained at one time. It is only intended to show which tables appear on tape, and not whether they were placed there by one or more logical transfers of data.

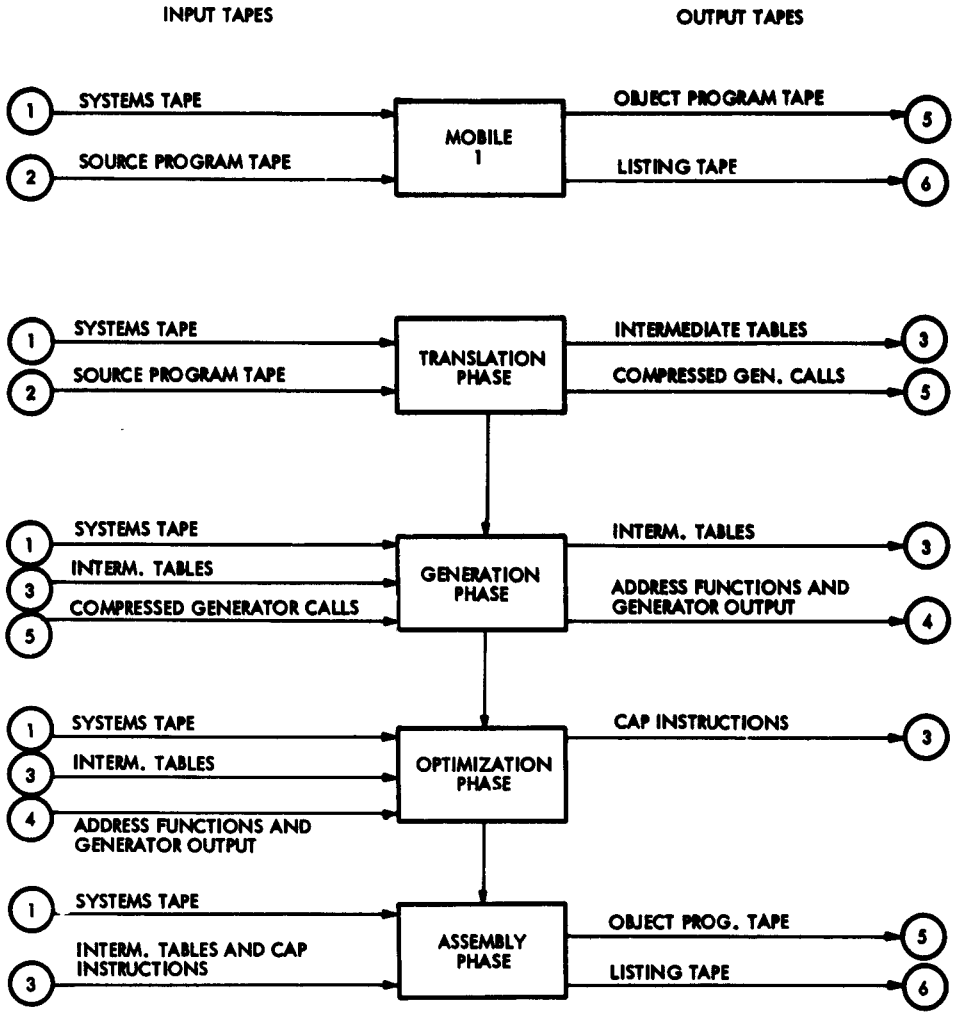

Figure 4-7. Input-Output Tape Assignment At Compilation

PROGRAM	TAPES		
	INPUT	OUTPUT	SCRATCH
TRANSLATION PHASE			
RUN 1.0 INITIALIZATION			
RUN 1.1 ENVIRONMENT DIVISION PROC.			
RUN 1.2 DATA DIVISION PROC.			4,5,6
RUN 1.3 PROCEDURE DIVISION PROC.		5,6	
RUN 1.4 END-TRANSLATION	6		
GENERATION PHASE			
RUN 2 GENERATOR CALL SORT	5	5	6
RUN 4 DATA INFORMATION RUN	5	4,6	
RUN 3 GENERATOR RUN	6	4,5	
OPTIMIZATION PHASE			
RUN 5 MACRO INSTRUCTION SORT	4	5,6	6
RUN 6 OPTIMIZATION	5,6		4,5,6
ASSEMBLY PHASE			
RUN 7 PRE-ASSEMBLY		4	
RUN 8 ASSEMBLY		4,5,6	

Figure 4-8. Usage of Tape 4, 5 and 6 for each Compilation Run

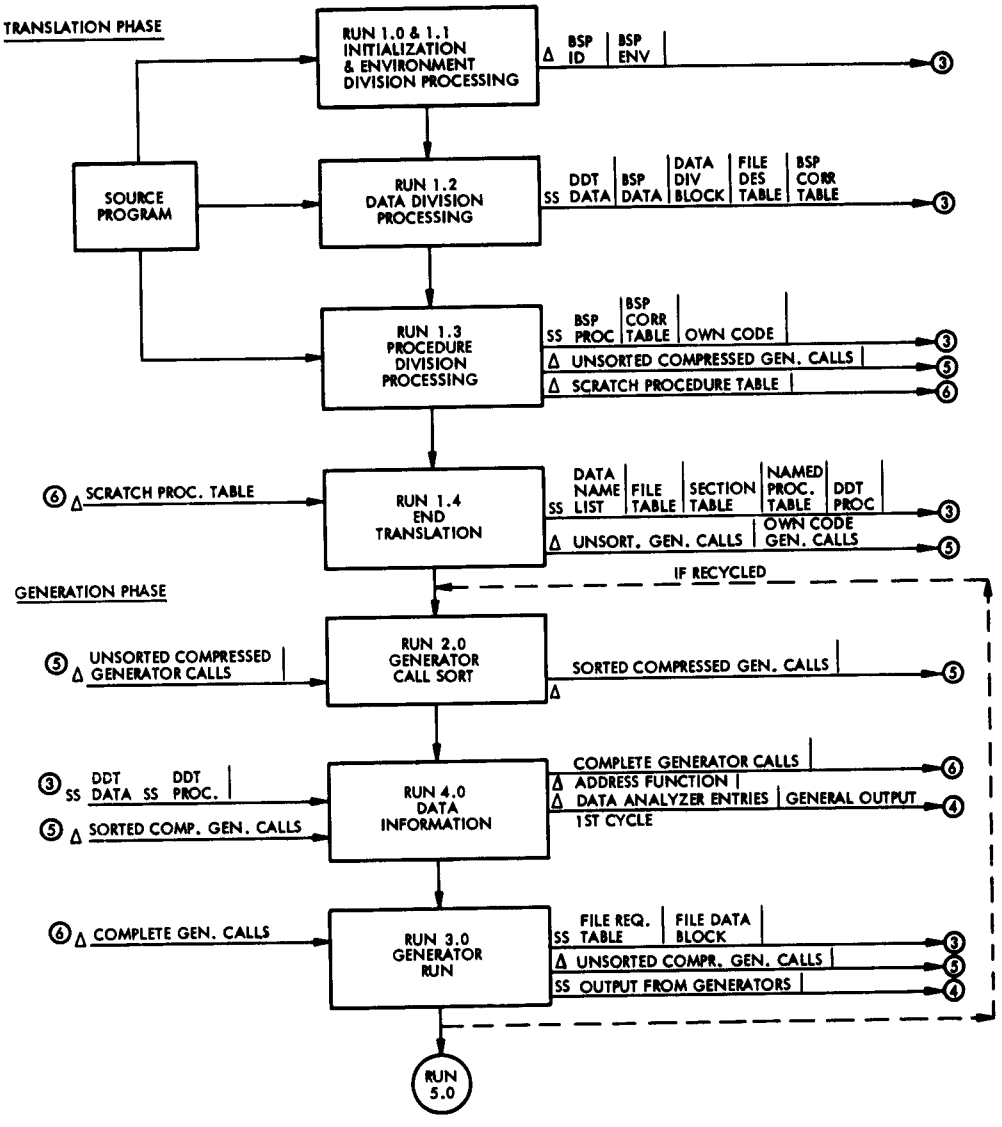

Figure 4-9. Tables On Input-Output Tapes At Compilation Runs

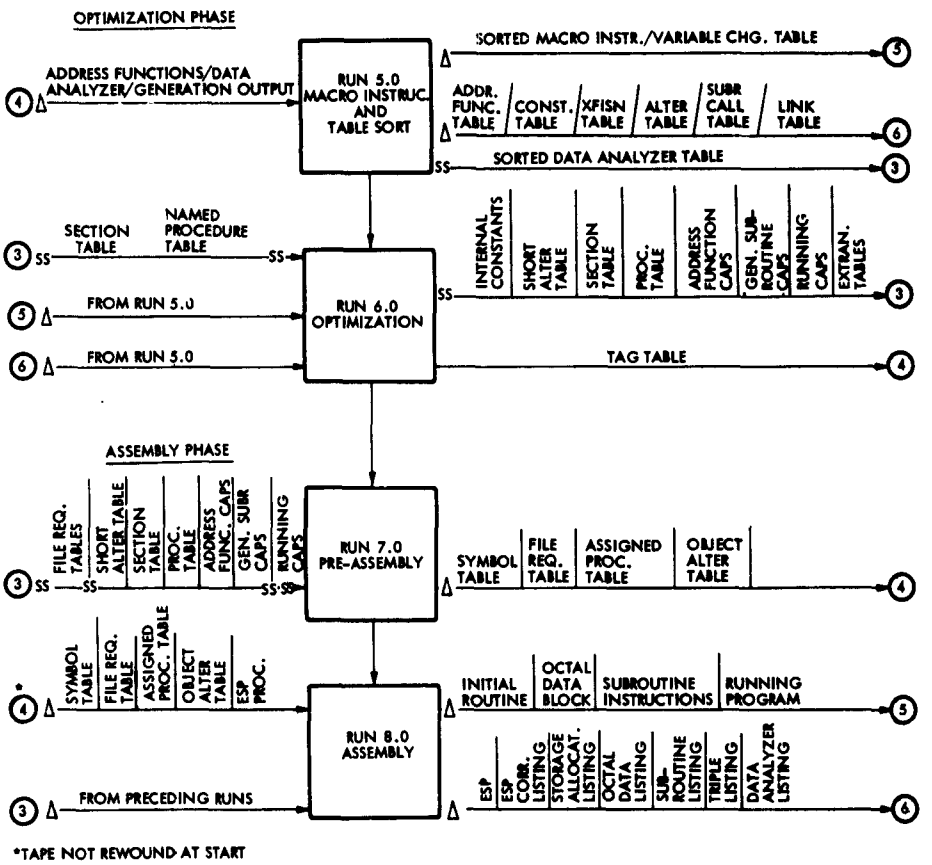

Figure 4-9. Tables on Input-Output Tapes at Compilation Runs (Cont.)

TABLE 4-2. DETAILED USE OF TAPES AT COMPILATION

Run No.	Tape No.	Input	Tape Operation	Output	Tape No.
1.0		Source Program	WR LFON	Δ Blocked Source Program	3
1.1		Source Program	WR LFON	SS Blocked Source Program	3
			WR T12N	SS Table Dump	3
1.2		Source Program	WR TN00	Δ Record DDT	6
			WR LM00	Δ Data List	4
	4	Δ Data List	RD LM00		
	6	Δ Record DDT	RD TN00		
			WR TQON	Δ Unordered Copy Set	4
	4	Δ Unordered Copy Set	RD TQON		
			WR TQ00	Δ Ordered Copy Set	5
	6	Δ Record DDT	RD TN00		
	5	Δ Ordered Copy Set	RD TQ00		
	3		RD T32N	SS Table Dump	
			WR TWON	Data Design Table	3
			WR TW00	Data Design Table	4
	4	Δ Data Design Table	RD TW00		
			WR LPON	SS Blocked Source Program	3
			WR BXON	SS Data Division Block	3
			WR TVON	SS File Description Table	3
			WR TXON	SS BSP Correction Table	3

TABLE 4-2. DETAILED USE OF TAPES AT COMPILATION (Cont.)

Run No.	Tape No.	Input	Tape Operation	Output	Tape No.
1.3		Source Program	WR LP1N	SS BSP Proc. Division	3
			WR OW1N	SS Own Code	3
			WR GA1N	Δ Unsorted Comp. Gen. Calls	5
			WR TH11	Δ Scratch Proc. Table	6
			WR TX1N	SS BSP Correction Table	3
1.4			WR LN01	SS Data Name List	3
			RD OW1N	SS Own Code	3
			WR TU01	SS File Table	3
			WR TA1N	SS Section Table	3
	6	Δ Scratch Proc. Table	RD TH11		
			WR TB1N	SS Named Proc. Table	3
			WR TD1N	SS Data Design Table (Proc.)	3
2	5	Δ Unsorted Compressed Gen. Calls	RD GA1N		
			WR GD2N	Δ Sorted Compr. Gen. Calls	5
4	3	SS DDT Data SS DDT Proc.	RD TWON TD1N		
	5	Δ Sorted Compressed Gen. Calls	WR GB4N	Δ Complete Gen. Calls	6
			WR TA3N	Address Function & Data Analyzer Entries Δ 1st Cycle SS IF Recycled	4

TABLE 4-2. DETAILED USE OF TAPES AT COMPILATION (Cont.)

Run No.	Tape No.	Input	Tape Operation	Output	Tape No.
3	6	Δ Complete Gen. Calls	RD GB4N		
			WR T19N	SS File Requirement Table	3
			WR BY9N	SS File Data Block	3
			WR BX9N	SS TAPDAT Table	5
			WR BZ9N	SS MFPDAT Table	5
	6	SS Complete Gen. Calls	RD GB4N		
			WR GA1N	Δ Unsorted Compressed Gen. Calls	5
			WR TA3N	SS Output From Generators	4
5	4	Δ Address Function, Data Analyzer & Generation Output	RD TA3N		
			WR MA35	Δ Sorted Macro Instruction	5
			WR TJ45	Δ Address Function Table	6
			WR TC35	SS Constant Table	6
			WR TD35	SS XFISN Table	6
			WR TF35	SS Alter Table	6
			WR TG35	SS Subroutine Call Table	6
			WR TH35	SS Link Table	6
			WR TK45	SS Data Analyzer Table	3
6	6	Δ Address Function Table SS	RD TJ45		
			WR TJ66	Δ Compressed Add. Func. Table	4
	4	Δ Compressed Add. Function Table	RD TJ66		
	6	SS Constant Table	RD TC35		
			WR BC6N	SS Internal Constant Block	3

TABLE 4-2. DETAILED USE OF TAPES AT COMPILATION (Cont.)

Run No.	Tape No.	Input	Tape Operation	Output	Tape No.
	6	SS XFISN Table	RD TD35		
	6	SS Alter Table	RD TF35		
			WR TF6N	SS Short Alter Table	3
	3	SS Section Table	RD TA1N		
	3	SS Named Proc. Table	RD TB1N		
			WR TA36	SS Section Table	3
			WR TB36	SS Procedure Table	3
	4	Δ Compr. Address Function Table	RD TJ66		
			WR MF6N	SS Address Function Caps	3
	6	SS Subroutine Call Tables	RD TG35		
			WR MS6N	SS Generator Subr. Caps	3
	6	SS Link Table	RD TH35		
	5	Δ Sorted Macro Inst. SS	RD MA35		
			WR TL66		3
			WR TK66		4
			WR MD66	Δ Modified Macro	6
	6	Δ Modified Macro	RD MD66		
			WR MR6N	SS Running Caps	3
			WR	SS Extran. Tables	3
7	3	SS File Req. Table	RD T19N		
	3	SS Short Alter Table SS	RD TF6N		
	3	SS Section Table	RD TA36		
	3	SS Proc. Table	RD TB36		
	3	SS Address Func. Caps SS	RD MF6N		

TABLE 4-2. DETAILED USE OF TAPES AT COMPILATION (Cont.)

Run No.	Tape No.	Input	Tape Operation	Output	Tape No.
	3	SS Gen. Subr. Caps	RD MS6N		
	3	SS Running Caps	RD MR6N		
			WR TM7N	Δ Symbol Table	4
			WR T197	SS File Requirement Table	4
			WR TB7N	SS Assigned Procedure Table	4
			WR BA7N	SS Object Alter Table	4
8	3	SS Data Div. Block	RD BXON		
		SS BSP Corr. Table Data	RD TXON		
		SS BSP Corr. Table Proc.	RD TX1N		
		Δ BSP	RD LFON		
		SS BSP	RD LPON		
		SS BSP	RD LP1N		
			WR PA8N	Δ Expanded Source Program	6
			WR LP18	SS ESP Procedure Division	4
			WR PB8N	SS ESP Correction Listing	6
	4	Δ Symbol Table	RD TM7N		
	4	SS File Req. Table	RD T197		
	4	SS Assigned Proc.	RD TB 7n		
			WR BZ8N	Δ Initial Routine	5
			WR PC8N	SS Storage Allocation Listing	6
	3	SS File Data BL.	RD BY9N		
	3	SS Internal Constant	RD BC6N		
	4	SS Object Alter Table	RD BA7N		

TABLE 4-2. DETAILED USE OF TAPES AT COMPILATION (Cont.)

Run No.	Tape No.	Input	Tape Operation	Output	Tape No.
			WR BD8N	SS Octal Data Block	5
			WR PD8N	SS Octal Data Listing	6
	3	SS Address Func. Caps	RD MF6N		
		Gen. Subr. Caps	RD MS6N		
			WR BS8N	SS Subroutine Instructions	5
			WR PS8N	SS Subroutine Listing	6
	3	SS Running Caps	RD MR6N		
	4	SS ESP Proc.	RD LP18		
			WR BR8N	SS Running Program	5
			WR PE8N	SS Triple Listing	6
	3	SS Data Name List	RD LN01		
	3	SS Data Analyzer	RD TK45		
			WR PG8N	SS Data Analyzer Listing	6

4.5 FORMAT AND USAGE OF THE COMPILER SYSTEMS TAPE

4.5.1 Contents of the Systems Tape

The Systems Tape is made up of labeled files; each file being a particular "Compiler Run" or auxiliary program.

4.5.1.1 Programs on the Systems Tape

The following routines are on the Systems Tape:

Name	Function	File No.
LABEL	Tape Label	See Note No. 1
LOADER	Systems Loader	See Note No. 2
SPINA	Control and Input/Output	1
CDIR	Systems Directory	2
SL02	Systems Tape Generator	3
M10N	Initialization	4
M11N	Environment Division Processing	5
M12N	Data Division Processing	6
M13N	Procedure Division Processing	7
M14N	End Translation	8
M02N	Generator Call Sort	9
M03N	Data Information Run	10
M04N	Generator Run	11
M05N	Macro-instruction Sort	12
M06N	Optimization	13
M07N	Pre-Assembly	14
M08N	Assembly	15

Note No. 1: An 8-word block is the first block on the Systems Tape. This block is the tape label. It contains the MOBIDIC Compiler Systems Tape and the date the tape was generated.

Note No. 2: The Systems Loader is not in a file, but is merely one block that sits as the second block on the tape. By sensing SFF1, the System Loader determines whether to read in the Control Program or the Systems Tape Generator Program.

4.5.1.2 Expansion

The Systems Tape is flexible in that it can be either expanded or contracted; however, it is essentially a complete system.

4.5.2 Header and Trailer Blocks

There is a header block and a trailer block in each file on the Systems Tape. These blocks are created by the Systems Tape Generator Program and are used by the Control Program during compilation time. They serve as the control mechanisms for reading in the various runs.

4.5.2.1 Format of the Header and Trailer Blocks

The header and trailer blocks in any one file are identical to one another. They consist of 10 words each; however, only the first 3 words are used currently. Word 1 contains the program identification, e.g., for Run 1.0, word 1 would contain 226160230505 which is equivalent to M10N, the run identification. Terminating blocks are spaced filled. Word 2 contains the file number and the number of blocks in the file, e.g., if word 2 contained 000001600005_8 it would mean it was file No. 5 and it contained 16 octal blocks. Word 3 contains the starting address of the program in the alpha portion. As was stated previously, words 4 – 10 are not used currently.

4.5.3 Putting Programs on the Systems Tape

Means by which a program or a new version of a program is put on the Systems Tape:

1. The Control Card must be put in as the first card in the binary deck. The Control Card has to be in the following format: it must be ISN; 12-row left will have a word count of 1 and an address of 37777_8. (Note: there is no relationship of the 37777_8 on the Control Card and the fact that memory is limited to 17777_8.); 12-row right may or may not contain a hashsum, but it may not, however, ignore the hashsum punch. 11-row left must have the program identification, e.g., for Run 1.3 11-row left must contain 226163230505 representing M13N, the identification for Run 1.3.

2. The normal transfer card must be replaced with a transfer to 1. However, there is one exception, if the program is the last program in any series of programs being put on the Systems Tape or is the only program being added to the tape, it must have a transfer to 2 instead of 1.

4.5.3.1 Program Starting Locations

The lowest location of any program on the Systems Tape must contain a transfer to the starting location of the program.

SECTION V

CONCLUSIONS

5.1 CONCLUSIONS

Most of the coding necessary to modify the runs specified in the First Quarterly Report is complete. The next logical step is to test each run to insure its functioning as a unit and also as an integral part of a system, namely, MOBILE. The unit testing has begun to check out the relation of one run to another in the overall system.

SECTION VI

PROGRAM FOR THE NEXT PERIOD

During the next period each run of MOBIDIC MOBILE I will undergo regorous test procedures until specifications are met. When this occurs, all the runs will be integrated to form the MOBILE system which in turn, will undergo a series of equally rigorous tests. Once MOBILE I functions effectively as a system, it will be subjected to Acceptance Testing to ensure complete satisfaction of the purchaser's contract specifications. These tests will be a series of COBOL source programs from which MOBILE I will produce object code and listings in accordance with the rules of COBOL and MOBILE I. These object programs should then function in the manner prescribed by the user if the COBOL statements used in the Source Program are free from logical and COBOL errors.

SECTION VII

IDENTIFICATION OF KEY PERSONNEL

7.1 KEY TECHNICAL PERSONNEL

Alvin H. Hatch	Manager, Applied Programming Dept.
Arthur S. Morse	Section Head, Language Implementation Section
Herbert S. Hughes	Research Engineer
Roy Sundgren	Senior Engineer
Richard Mackler	Senior Engineer

7.2 APPROXIMATE MAN-HOURS EXPENDED

Name	Hours
Alvin H. Hatch	132
Arthur S. Morse	160
Herbert S. Hughes	412
Roy Sundgren	503
Richard Mackler	352
Total	1559

APPENDIX A

RUN 1.0 PROGRAM LISTING

```
                REM     PACKAGE IV     MOBILE, I      AUGUST  1962
                LST
          IPRO  MACRO   A,I,M
                VFD     1/0,06/65,3/I,12/M,15/A
                END
          IHLT  MACRO   A,I,M
                VFD     1/0,06/64,3/I,12/M,15/A
                END
          PRE   MACRO   A,I,M                                          R110
                VFD     1/0,06/63,3/I,12/M,15/A                      R110
                END                                                  R110
000000LSX       MACRO   A,I,M                                        R100
000100          LOD     =A,0,I                                       R100
000200          LOD     =M,0,I+1                                     R100
000300          END                                                  R100
                WIPE    1
                RST                                                  R110
                REM
000400          ORG     /37777                                       R100
000500          BCI     1,M10N                                       R100
                ORG     TE1A-1
                TRU     ZZ
                OCT     1400110
                VFD     1/0,9/0,12/11,15/2
                BCZ     5,ACCUMULATOR
                VFD     1/0,9/0,12/10,15/4
                BCZ     5,CARD-PUNCH
                VFD     1/0,9/0,12/14,15/6
                BCZ     5,CARD-PUNCH-ISN
                VFD     1/0,9/0,12/11,15/CDR
                BCZ     5,CARD-READER
                VFD     1/0,9/0,12/15,15/5
                BCZ     5,CARD-READER-ISN
                VFD     1/0,9/0,12/11,15/FLX
                BCZ     5,FLEXOWRITER
                VFD     1/0,9/0,12/9,15/1
```

```
                BCZ     5,HALF-PAGE
                VFD     1/0,9/0,12/15,15/LPR
                BCZ     5,ON-LINE-PRINTER
                VFD     1/0,9/0,12/4,15/0
                BCZ     5,PAGE
                VFD     1/0,9/0,12/16,15/PTP8
                BCZ     5,PAPER-TAPE-PUNCH
                VFD     1/0,9/0,12/17,15/PTR8
                BCZ     5,PAPER-TAPE-READER
                VFD     1/0,9/0,12/20,15/3
                BCZ     5,WORD-SWITCH-REGISTER
                ORG     TT1L
        TC00I   EQU     TT1I            BSP CORRECTIONS         R100
        TC00C   EQU     TT1C                                    R100
        TC00W   EQU     TT1W                                    R100
        TC00B   EQU     TT1B                                    R100
        TC00T   EQU     TT1T                                    R100
        TC00S   EQU     TT1S                                    R100
        TC00A   EQU     TT1A                                    R100
        TC00L   EQU     TT1L                                    R100
003300TC0NI     EQU     TM1I            CONTROL BLOCK.          R100
003400TC0NC     EQU     TM1C                                    R100
003500TC0NW     EQU     TM1W                                    R100
003600TC0NB     EQU     TM1B                                    R100
003700TC0NT     EQU     TM1T                                    R100
003800TC0NS     EQU     TM1S                                    R100
003900TC0NA     EQU     TM1A                                    R100
004000TC0NL     EQU     TM1L                                    R100
004100LL00I     EQU     TM2I                                    R100
004200LL00C     EQU     TM2C                                    R100
004300LL00W     EQU     TM2W                                    R100
004400LL00B     EQU     TM2B                                    R100
004500LL00T     EQU     TM2T                                    R100
004600LL00S     EQU     TM2S                                    R100
004700LL00A     EQU     TM2A                                    R100
004800LL00L     EQU     TM2L                                    R100
```

```
008900TB00I  BSS     1                                          R100
009000TB00C  BSS     1                                          R100
009100TB00W  BSS     1                                          R100
009200TB00B  BSS     1                                          R100
009300TB00T  BSS     1                                          R100
009400TB00S  EQU     14                                         R100
009500TB00A  BSS     5                                          R100
009600TB00L  EQU     TB00A                                      R100
010500TD00I  BSS     1                                          R100
010600TD00C  BSS     1                                          R100
010700TD00W  BSS     1                                          R100
010800TD00B  BSS     1                                          R100
010900TD00T  BSS     1                                          R100
011000TD00S  EQU     24                                         R100
011100TD00A  BSS     TD00S                                      R100
011200TD00L  EQU     TD00A                                      R100
011300LA00I  BSS     1                                          R100
011400LA00C  BSS     1                                          R100
011500LA00W  BSS     1                                          R100
011600LA00B  BSS     1                                          R100
011700LA00T  BSS     1                                          R100
011800LA00S  EQU     14                                         R100
011900LA00A  BSS     LA00S                                      R100
012000LA00L  EQU     LA00A                                      R100
      BSPA   BSS     15          TEMPORARY FOR DATE
             IST
       INTBF BSS     42
012100       LOC     LCTBLE                                     R100
012200ZZ     MOV     PCS,ZYX                                    R100
013000       MOV     =10,1C                                     R100
             SNR     *+1,0,00F0C
             SNR     *+1,0,01F0C
             SNR     *+1,0,02F0C
             SNR     *+1,0,03F0C
             SNR     *+1,0,04F0C
             SNR     *+1,0,05F0C
```

```
                SNR     *+1,0,06F0C
                SNR     *+1,0,07F0C
                SNR     *+1,0,08F0C
                SNR     *+1,0,09F0C
                MVZ     LA00C
                MOV     HFC3-1,15M
012300          MOV     =/100000077740,S1                                       R100
012500          MVZ     LA00T                                                   R100
012600          MVZ     LL00C                                                   R100
                MOV     =14,LL00W
                MOV     =1,TC00W
                MOV     =1,IR2          SET NAME LOCATION TO BLANKS             R100
                RPT     5,0,0                                                   R100
                MOV     =/050505050505,TI1A+1                                   R100
012900          MOV     =/300025,TC00A                                          R100
014100          MOV     =1,IR2                                                  R100
014200          RPT     13,0,1                                                  R100
014300          MOV     LL00A+1,LA00A                                           R100
014400R         LOD     ZERO,0,IR3      LOAD INDEX                              R100
014500          LOD     =/7777,0,IR4    REGISTERS                               R100
014600R6        TRL     S1              GET A WORD                              R100
014700          CLA     TB00A           PICK UP WORD                            R100
014800          LGM     =/770000000000  IS THERE A WORD                         R100
014900          TRC     =/050000000000                                          R100
015000          TRU     *+3             YES                                     R100
015100          TRU     *+2             YES                                     R100
015200          TRU     R2              NO                                      R100
015300R7        CLA     TB00A                                                   R100
015400          TRX     *+1,3,1         YES                                     R100
015500          TRC     M,3                                                     R100
015600          TRU     R1              NO MATCH                                R100
015700          TRU     R1              NO MATCH                                R100
015800          CLA     M+1,3           PICK UP SECOND WORD                     R100
015900          TRN     R3                                                      R100
016000          RPA     PCT             MATCH FOUND                             R100
016100R1        CLA     M+2,3           NO MATCH                                R100
```

```
016200          RPA     PCT                                             R100
016300R2        CLA     M,3             ADJUST FOR NO ENTRY             R100
016400          TRX     *+1,3,1                                         R100
016500          RPA     PCT                                             R100
016600R3        RPA     R4              CONTINUE TESTING                R100
016700          ADB     ACC,0,1                                         R100
016800          RPA     R5              FOR NO MATCH                    R100
016900          CLA     TB00A+1                                         R100
017000R4        TRC     **                                              R100
017100          TRU     R1              NO MATCH                        R100
017200          TRU     R1              NO MATCH                        R100
017300R5        CLA     **              MATCH                           R100
017400          RPA     PCT                                             R100
017500M1        TRX     R6,3,3                                          R100
017600M2        TRX     R6,3,6                                          R100
017700M3        TRX     R6,3,9                                          R100
017800M1A       TRX     R7,3,2                                          R100
017900M2A       TRX     R7,3,5                                          R100
018000M3A       TRX     R7,3,8                                          R100
018100M         HLT     M2                                              R100
018200          BCZ     1,CARD                                          R100
018300          HLT     MIC1                                            R100
018400          HLT     M1A                                             R100
018500          BCZ     1,TAPE                                          R100
018600          HLT     MIE1                                            R100
018700          HLT     MR              ERROR                           R100
018800          HLT     M1                                              R100
018900          BCZ     1,CARD          M1A                             R100
019000          HLT     MCC1                                            R100
019100          HLT     MR              ERROR                           R100
019200          HLT     M3                                              R100
019300          BCI     1,CARD                                          R100
019400          HLT     MOC1                                            R100
019500          HLT     M1A                                             R100
019600          BCZ     1,MAG-TA                                        R100
019700          VFD     1/1,21/0,15/MC1                                 R100
```

```
021800          HLT     MOT1                                            R100
021900MC2       VFD     1/0,F6/T,018/050505,12/0                        R100
                HLT     MR
022100MC3       BCZ     1,MBLY                                          R100
                HLT     MR
022300MC4       BCZ     1,RT                                            R100
022400          HLT     M1                                              R100
022500MIC1      CLA     ZERO                    INPUT ON CARDS          R100
022600          LDQ     =/14                                            R100
022700          MSK     TCONA+1                                         R100
022800          TRU     M2                      GET NEXT WORD           R100
022900MIE1      CLA     =/10                    INPUT ON TAPE           R100
023000          LDQ     =/14                                            R100
023100          MSK     TCONA+1                                         R100
023200          TRU     M1                                              R100
023300MR        TRL     ERR,1,FG1                                       R100
023400          TRU     M1                                              R100
      MCC1      SNS     *+1,0,00F0C             SET FLIX FOR CORRECTIWNS
023900          TRU     M1                                              R100
024000MOC1      CLA     ZERO                    OUTPUT ON CARDS         R100
024100          LDQ     =/3                                             R100
024200          MSK     TCONA+1                                         R100
024300          TRU     M3                                              R100
024400MOT1      CLA     =/1                     OUTPUT ON TAPE          R100
024500          LDQ     =/3                                             R100
024600          MSK     TCONA+2                                         R100
024700          TRU     M2                                              R100
024800MOB1      CLA     =/2                     OUTPUT ON TAPE AND CARDS R100
024900          LDQ     =/3                                             R100
025000          MSK     TCONA+2                                         R100
025100          TRU     M1                                              R100
025200MCL1      CLA     =/200000000             COMPATIBLE LISTING      R100
025300          LDQ     =/200000000                                     R100
025400          MSK     TCONA+2                                         R100
                TRU     M1
      BSP1      CLA     =/400000                NO BSP LISTING
```

```
                LDQ     =/400000
                MSK     TCONA+1
                TRU     M1
        CS1     CLA     =/200000        NO CORE STORAGE LISTING
                LDQ     =/200000
                MSK     TCONA+1
                TRU     M1
        TL1     CLA     =/200000        NO TRIPPLE LISTING
                LDQ     =/100000
                MSK     TCONA+1
                TRU     M1
        DA1     CLA     =/40000         NO DATA ANALYZER LISTING
                LDQ     =/40000
                MSK     TCONA+1
                TRU     N1
025600MPS1      TRU     M1                                              R100
025700S1        CLA     ACC                                             R100
025800          CLA     ZERO                                            R100
025900          LDQ     LA00A                                           R100
026000          SLL     24,0,3          GET FIRST WORD                  R100
026100          SHL     12,0,1                                          R100
026200          STR     TB00A                                           R100
026300          MOV     QRG,LA00A       SAVE NEXT WORD                  R100
026400          MOV     SA2,S1                                          R100
026500          TRS                     RETURN                          R100
026600S2        CLA     ZERO            GET SECOND WORD                 R100
026700          LDQ     LA00A                                           R100
026800          SLL     12,0,3                                          R100
026900          LDQ     LA00A+1                                         R100
027000          SLL     12,0,3                                          R100
027100          SHL     12,0,1                                          R100
027200          STR     TB00A                                           R100
027300          MOV     QRG,LA00A+1                                     R100
027400          MOV     SA3,S1                                          R100
027500          TRS                     RETURN                          R100
027600S3        CLA     ZERO                                            R100
```

```
027700          LDQ     LA00A+1                                         R100
027800          SLL     24,0,1          GET THIRD WORD                  R100
027900          LDQ     LA00A+2                                         R100
028000          SLL     12,0,1                                          R100
028100          STR     TB00A                                           R100
028200          CLA     ZERO                                            R100
028300          SLL     12,0,1                                          R100
028400          SHL     24,0,1                                          R100
028500          STR     TB00A+1                                         R100
028600          MOV     SA4,S1                                          R100
028700          MOV     QRG,LA00A+2                                     R100
028800          TRS                     RETURN                          R100
028900S4        LDQ     LA00A+2                                         R100
029000          CLA     ZERO                                            R100
029100          SLL     12,0,1                                          R100
029200          LDQ     LA00A+3                                         R100
029300          SLL     24,0,1                                          R100
029400          STR     TB00A                                           R100
029500          CLA     ZERO                                            R100
029600          SLL     12,0,1                                          R100
029700          LDQ     LA00A+4                                         R100
029800          SLL     12,0,1                                          R100
029900          SHL     12,0,1                                          R100
030000          STR     TB00A+1                                         R100
030100          MOV     QRG,LA00A+4                                     R100
030200          MOV     SA5,S1                                          R100
030300          TRS                     RETURN                          R100
030400S5        LDQ     LA00A+4         GET FIFTH WORD                  R100
030500          CLA     ZERO                                            R100
030600          SLL     24,0,1                                          R100
030700          LDQ     LA00A+5                                         R100
030800          SLL     12,0,1                                          R100
030900          STR     TB00A                                           R100
031000          CLA     ZERO                                            R100
031100          SLL     12,0,1                                          R100
031200          SHL     24,0,1                                          R100
```

```
031300          STR     TB00A+1                                         R100
031400          MOV     QRG,LA00A+5                                     R100
031500          MOV     SA6,S1                                          R100
031600          TRS                             RETURN                  R100
031700S6        CLA     ZERO                    GET SIXTH WORD .        R100
031800          LDQ     LA00A+5                                         R100
031900          SLL     12,0,1                                          R100
032000          LDQ     LA00A+6                                         R100
032100          SLL     6,0,1                                           R100
032200          SHL     18,0,1                                          R100
                STR     TB00A
                MOV     QRG,LA00A+6
                MOV     SA7,S1
032300          TRS                             RETURN                  R100
      S7        CLA     ZERO
                LDQ     LA00A+6
                SLL     12,0,1
                SHL     24,0,1
                STR     TB00A
                MOV     QRG,LA00A+6
                MOV     SA8,S1
                TRS
      S8        CLA     ZERO
                LDQ     LA00A+5
                SLL     12,0,1
                SHL     24,0,1
                STR     TB00A
                MOV     QRG,LA00A+6
                MOV     SA9,S1
                TRS
      S9        CLA     ZERO
                LDQ     LA00A+5
                SLL     6,0,1
                LDQ     LA00A+7
                SLL     6,0,1
                SHL     24,0,1
```

```
                STR     TB00A
                MOV     QRG,LA00A+7
                MOV     SA10,S1
                TRS
          S10   CLA     ZERO
                LDQ     LA00A+7
                SLL     12,0,1
                SHL     24,0,1
                STR     TB00A
                MOV     QRG,LA00A+7
                TRS
032400SA2       TRU     S2                                              R100
032500SA3       TRU     S3                                              R100
032600SA4       TRU     S4                                              R100
032700SA5       TRU     S5                                              R100
032800SA6       TRU     S6                                              R100
        SA7     TRU     S7
        SA8     TRU     S8
        SA9     TRU     S9
        SA10    TRU     S10
        N1      CLA     TC0NA+1
033200          LGM     =/14            IS INPUT ON CARDS               R100
033300          TRZ     *+2                                             R100
033400          TRU     N5              INPUT IS NOT ON CARDS           R100
034100          SEN     *+2,0,00F0C     ARE THERE ANY CORRECTIONS       R100
034200          TRU     N5              NO CORRECTIONS                  R100
                SNS     *+1,0,09F0C
034300N8        TRL     A               HAVE WE REACHED                 R100
034400          CLA     TB00A           END CORRECTIONS                 R100
034500          TRC     A10E            X                               R100
034600          TRU     N7              NO                              R100
034700          TRU     N7              NO                              R100
034800          TRL     A               TEST NEXT WORD                  R100
034900          CLA     TB00A           X                               R100
035000          TRC     N6              X                               R100
035100          TRU     N7                                              R100
```

```
035200          TRU     N7                                              R100
035300          CLA     TB00A+1                                         R100
035400          TRC     N6+1                                            R100
035500          TRU     *+1             ERROR                           R100
                TRL     ERR,1,FG1       ERROR                           R100
035700          SNS     *+1,0,WEF                                       R100
035800          TRL     WR,0,SP0        WRITE LAST BLOCK                R100
                HLT     LL00A
036000          HLT                     X                               R100
                CLA     =/1000000000
023600          LDQ     =/1000000000                                    R100
023700          MSK     TC0NA+2                                         R100
                MVZ     LA00C           RESET SEG NUMBERS
                SNR     SCAN,0,09F0C    RESET SPECIAL MODE
036500N7        MVZ     SAV3            RESET FOR NEXT                  R100
036600          MVZ     SAV4            CARD                            R100
036700          MVZ     LA00T                                           R100
036800          TRL     WR,0,SP0        WRITE OUT CORRECTION            R100
                HLT     LL00A
037000          HLT                     X                               R100
037100          TRU     N8              RETURN                          R100
037200N6        BCZ     2,CORRECTIONS                                   R100
037400ID        BCZ     1,IDENTI        IDENTIFICATION                  R100
037500          VFD     1/1,21/0,15/IDC8                                R100
037600          HLT     IDA                                             R100
037700          BCZ     1,DIVISI        DIVISION                        R100
037800          VFD     1/1,21/0,15/IDC9                                R100
037900          HLT     IDA                                             R100
038000          BCZ     1,PROGRA        PROGRAM-ID                      R100
038100          VFD     1/1,21/0,15/IDC1                                R100
038200          HLT     IDA                                             R100
038300          BCZ     1,AUTHOR        AUTHOR                          R100
038400          HLT     IDD                                             R100
038500          HLT     H1A                                             R100
038600          BCZ     1,DATE-W        DATE-WRITTEN                    R100
038700          VFD     1/1,21/0,15/IDC2                                R100
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038800          HLT     H1A                                             R100
038900          BCZ     1,DATE-C                DATE-COMPILED           R100
039000          VFD     1/1,21/0,15/IDC3                                R100
039100          HLT     H1A                                             R100
039200          BCZ     1,SECURI                SECURITY                R100
039300          VFD     1/1,21/0,15/IDC4                                R100
039400          HLT     H1A                                             R100
039500          BCZ     1,REMARK                REMARKS                 R100
039600          VFD     1/1,21/0,15/IDC5                                R100
039700          HLT     H1A                                             R100
039800          BCZ     1,INSTAL                INSTALLATION            R100
039900          VFD     1/1,21/0,15/IDC6                                R100
040000          HLT     H1A                                             R100
040100ID1       BCZ     1,ENVIRO                ENVIRONMENT             R100
040200          VFD     1/1,21/0,15/IDC7                                R100
040300          HLT     IDE                                             R100
040400IDC1      BCZ     1,M-ID                                          R100
040500          HLT     IDP                                             R100
040600IDC2      BCZ     1,RITTEN                                        R100
040700          HLT     IDD                                             R100
040800IDC3      BCZ     1,OMPILE                                        R100
040900          HLT     IDM                                             R100
041000IDC4      BCZ     1,TY                                            R100
041100          HLT     IDD                                             R100
041200IDC5      BCZ     1,S                                             R100
041300          HLT     IDD                                             R100
041400IDC6      BCZ     1,LATION                                        R100
041500          HLT     IDD                                             R100
041600IDC7      BCZ     1,NMENT                                         R100
041700          HLT     IDN                                             R100
041800IDC8      BCZ     1,FICATI                                        R100
041900          HLT     IDA1                                            R100
042000IDC9      BCZ     1,ON                                            R100
042100          HLT     IDA2                                            R100
042200IDA1      CLA     TB00A+2         FINISH WORD CHECK               R100
042300          TRC     A7D                                             R100
```

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042400          TRU     *+1                                             R100
042500          TRL     ERR,1,FG1                                       R100
042600          TRU     H1                                              R100
042700IDA2      SEN     H1,0,00F0C          IS THERE A PERIOD           R100
042800          TRL     ERR,1,FG11           NO PERIOD                  R100
042820          TRU     H1                                              R100
      IDP3      CLA     TB00C                                           R100
                RPA     IDP2                                            R100
                TRU     IDP5                                            R100
043000IDP       SEN     *+2,0,00F0C         IS THERE A PERIOD           R100
043100          TRL     ERR,1,FG11                                      R100
043200          TRL     A                   GET NAME                    R100
043300          TRL     J                   CHECK RESERVER WORD         R100
043400          TRL     ERR,1,FG1                                       R100
                MVZ     IR1                 STORE NAME FOR RUN 8        R100
                CLA     TB00C                                           R100
                SUB     =1,0,1
                TRZ     IDP3                                            R100
                CLA     ZERO                                            R100
                LDQ     TB00C                                           R100
                DVL     =6,0,1
                MOV     TB00W,IR2                                       R100
                RPA     IDP2                                            R100
                TRX     *+1,1,0                                         R100
      IDP4      CLA     TB00A,1                                         R100
                STR     TI1A+1,1                                        R100
                TRX     IDP4,1,1                                        R100
      IDP5      CLA     ZERO                                            R100
                LDQ     =/050505050505                                  R100
      IDP2      SLL     **,0,1
                LGA     TB00A+1,1                                       R100
                STR     TI1A+2,1                                        R100
043500          SEN     IDP1,0,00F0C                                    R100
043600          TRL     ERR,1,FG11                                      R100
043700IDP1      MOV     =9,IR3              RESET INDEX REGISTERS       R100
043800          MOV     =/7777,IR4                                      R100
```

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043900          MVZ     CNT1                    RETURN TO SCAN                  R100
044000          TRU     SCN1                                                    R100
044200IDD       SEN     *+2,0,00F0C             IS THERE A PERIOD               R100
044300          TRL     ERR,1,FG11                                              R100
044400IDD1      TRL     A                       GET NEXT WORD                   R100
044500          MOV     =1,CNT1                                                 R100
044600          TRL     CK                                                      R100
044700          TRL     ERR,1,FG10                                              R100
044800          SEN     IDP1,0,00F0C            IS THERE A PERIOD               R100
044900          TRU     IDD1                                                    R100
045000IDM2      BCZ     1,D                                                     R100
045100IDM       CLA     TB00A+2                                                 R100
045200          TRC     IDM2                                                    R100
045300          TRU     *+1                                                     R100
045400          TRL     ERR,1,FG1                                               R100
                TRU     DATE1                   TEST FOR DATE
        IDN     MOV     =2,3C                   END OF RUN
046100          MOV     ZYX,PCT                 EXIT FROM RUN                   R100
046600ZYX       HLT                             STORAGE FOR EXIT                R100
      DATE1     SEN     *+2,0,00F0C             IS THERE A PERIOD
                TRL     ERR,1,FG11
                ADB     ZERO,2,2
                CLA     WSR                     IS DATE GIVEN
                TRZ     IDD                     NO DATE
                SRL     20                      SET IN PRINTING FORM
                LGA     =/050505050560
      DATE2     SHL     2,0,7
                SLL     4,0,7
                LGA     =/60                    ALL OF MONTH
                STR     BSPA+4
                SHL     8,0,7
                SLL     4,0,7
                LGA     =/0560
                TRX     DATE2,1,0
                SHL     2,0,7
                SLL     4,0,7
```

```
                LGA     =/60
                SHL     18,0,7
                LGA     =/05050505
                STR     BSPA+5
                MOV     =1,IR2
                RPT     2,0,1
                MOV     DATE3,BSPA+1
                RPT     8,0,0
                MOV     =/050505050505,BSPA+6
                SNS     *+1,0,02F0C
                TRL     A                       GET A WORD
                SEN     *+2,0,00F0C             IS THERE A PERIOD
                TRU     *-2                     NO
                MOV     =1,IR2                  PERIOD
                RPT     12,0,1                  PUT WORD IN OUTPUT
                MOV     BSPA+1,TM2A+1
                MVZ     SAV4                    SET UP TO READ
                MVZ     LA00T                   A NEW CARD
                SNR     IDP1,0,02F0C            CONTINUE
      DATE3     VFD     1/0,F36/DATE-C
                VFD     1/0,F36/OMPILE
                VFD     1/0,F12/D.,024/05050505
046700J         MOV     IR3,J10                 SAVE IRS                        R100
046800          MOV     IR4,J11                 X                               R100
046900          LDQ     TB00A                   PICK UP FIRST 6 CHARACTERS      R100
047000          CLA     ZERO                    X                               R100
047100          SLL     6,0,3                   X                               R100
047200          STR     IR4                     INTO INDEX 4                    R100
047300          CLA     LG00A,4                 PICK UP KEY                     R100
047400          TRN     J8                      NO NEED TO SEARCH               R100
047500          TRZ     J9                      NO NEED TO SEARCH-ERROR         R100
047600          RPA     J3                           SET COMPARE ADDRESS        R100
047700          ADB     ACC,0,1                                                 R100
047800          RPA     J4                                                      R100
047900          SHR     15                                                      R100
048000          STR     IR4                     PUT COUNT IN INDEX              R100
```

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048100          MVZ     IR3             X                       R100
048200          CLA     TB00A           PICK UP 6 CHARACTERS    R100
048300J3        TRC     **,3            SEARCH TABLE            R100
048400          TRU     J6                                      R100
048500          TRU     J6                                      R100
048600          TRU     J4              FINISH MATCH            R100
048700J6        TRX     J3,3,2          HAVE WE FINISHED        R100
048800J8        ADB     PCS,0,1              RETURN NO MATCH    R100
048900          TRU     J7                                      R100
049000          ADB     ACC,0,1                                 R100
049100          RPA     J4                                      R100
049200J4        CLA     **,3                                    R100
049300          TRZ     J7                                      R100
049400          RPA     J5                                      R100
049500          SHR     15                                      R100
049600          STR     IR2                                     R100
049700          MVZ     IR1                                     R100
049800J5        TRC     **,1                                    R100
049900          TRU     J6              SEARCH REST OF TABLE    R100
050000          TRU     J6              SEARCH REST OF TABLE    R100
050100          TRX     J5,1,1                                  R100
050200J7        MOV     J10,IR3         LOAD IRS                R100
050300          MOV     J11,IR4         X                       R100
050400          TRS                     RETURN                  R100
050500J9        TRU     J8              ILLEGAL CHARACTER       R100
050600J10       HLT                                             R100
050700J11       HLT                                             R100
050800LG00A     HLT                     00                      R100
050900          HLT                     01                      R100
051000          HLT                     02                      R100
051100          HLT                     03                      R100
051200          HLT                     04                      R100
051300          HLT                     05                      R100
051400          HLT     A1A,0,XA/2      06                      R100
051500          HLT     A1B,0,XB/2      07                      R100
051600          HLT     1CA,0,XC/2      10                      R100
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051700          HLT     A1D,0,XD/2      11              R100
051800          HLT     A1E,0,XE/2      12              R100
051900          HLT     A1F,0,XF/2      13              R100
052000          HLT     A1G,0,XG/2      14              R100
052100          HLT     A1H,0,XH/2      15              R100
052200          HLT     A1I,0,XI/2      16              R100
052300          HLT     A1J,0,XJ/2      17              R100
052400          OCT     -0              20              R100
052500          HLT     A1L,0,XL/2      21              R100
052600          HLT     A1M,0,XM/2      22              R100
052700          HLT     A1N,0,XN/2      23              R100
052800          HLT     A1O,0,XO/2      24              R100
052900          HLT     A1P,0,XP/2      25              R100
053000          HLT     A1Q,0,XQ/2      26              R100
053100          HLT     A1R,0,XR/2      27              R100
053200          HLT     A1S,0,XS/2      30              R100
053300          HLT     A1T,0,XT/2      31              R100
053400          HLT     A1U,0,XU/2      32              R100
053500          HLT     A1V,0,XV/2      33              R100
053600          HLT     A1W,0,XW/2      34              R100
053700          OCT     -0              35              R100
053800          OCT     -0              36              R100
053900          HLT     A1Z,0,XZ/2      37              R100
054000          OCT     0               40              R100
054100          OCT     -0              41              R100
054200          OCT     0               42              R100
054300          OCT     0               43              R100
054400          OCT     0               44              R100
054500          OCT     0               45              R100
054600          OCT     0               46              R100
054700          OCT     0               47              R100
054800          OCT     0               50              R100
054900          OCT     0               51              R100
055000          OCT     0               52              R100
055100          OCT     0               53              R100
055200          OCT     0               54              R100
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055300          OCT     0                       55                      R100
055400          OCT                             56                      R100
055500          OCT     0                       57                      R100
055600          OCT     -0                      60                      R100
055700          OCT     -0                      61                      R100
055800          OCT     -0                      62                      R100
055900          OCT     -0                      63                      R100
056000          OCT     -0                      64                      R100
056100          OCT     -0                      65                      R100
056200          OCT     -0                      66                      R100
056300          OCT     -0                      67                      R100
056400          OCT     -0                      70                      R100
056500          OCT     -0                      71                      R100
056600          OCT     -0                      72                      R100
056700          OCT     0                       73                      R100
056800          OCT     0                       74                      R100
056900          OCT     0                       75                      R100
057000          OCT     0                       76                      R100
057100          OCT     0                       77                      R100
057200A1A       BCZ     1,ABOUT                                         R100
057300          HLT                                                     R100
057400          BCI     1,ACCEPT                                        R100
057500          HLT                                                     R100
057600          BCZ     1,ACCUMU                                        R100
057700          HLT     A7A,0,1                                         R100
057800          BCZ     1,ADD                                           R100
057900          HLT                                                     R100
058000          BCZ     1,ADDRES                                        R100
058100          HLT     A2A,0,1                                         R100
058200          BCZ     1,ADVANC                                        R100
058300          HLT     A3A,0,1                                         R100
058400          BCZ     1,AFTER                                         R100
058500          HLT                                                     R100
058600          BCZ     1,ALL                                           R100
058700          HLT                                                     R100
058800          BCZ     1,ALPHAB                                        R100
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058900          HLT     A4A,0,1                                 R100
059000          BCZ     1,ALPHAN                                R100
059100          HLT     A5A,0,1                                 R100
059200          BCZ     1,ALTER                                 R100
059300          HLT                                             R100
059400          BCZ     1,ALTERN                                R100
059500          HLT     A6A,0,1                                 R100
059600          BCZ     1,AN                                    R100
059700          HLT                                             R100
059800          BCZ     1,AND                                   R100
059900          HLT                                             R100
060000          BCZ     1,APPLY                                 R100
060100          HLT                                             R100
060200          BCZ     1,ARE                                   R100
060300          HLT                                             R100
060400          BCZ     1,AREA                                  R100
060500          HLT                                             R100
060600          BCZ     1,AREAS                                 R100
060700          HLT                                             R100
060800          BCZ     1,AS                                    R100
060900          HLT                                             R100
061000          BCZ     1,ASSIGN                                R100
061100          HLT                                             R100
061200          BCZ     1,AT                                    R100
061300          HLT                                             R100
061400A1B       BCZ     1,BEFORE                                R100
061500          HLT                                             R100
061600          BCZ     1,BEGINN                                R100
061700          HLT     A2B,0,1                                 R100
061800          BCZ     1,BEGINN                                R100
061900          HLT     A3B,0,3                                 R100
062000          BCZ     1,BEGINN                                R100
062100          HLT     A4B,0,3                                 R100
062200          BCZ     1,BIT                                   R100
062300          HLT                                             R100
062400          BCZ     1,BITS                                  R100
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062500          HLT                                                  R100
062600          BCZ     1,BLANK                                      R100
062700          HLT                                                  R100
062800          BCZ     1,BLOCK                                      R100
062900          HLT                                                  R100
063000          BCZ     1,BLOCK-                                     R100
063100          HLT     A5B,0,1                                      R100
063200          BCZ     1,BY                                         R100
063300          HLT                                                  R100
0634001CA       BCZ     1,CARD-P                                     R100
063500          HLT     A14C,0,1                                     R100
063600          BCZ     1,CARD-R                                     R100
063700          HLT     A13C,0,1                                     R100
063800          BCZ     1,CHARAC                                     R100
063900          HLT     2CA,0,1                                      R100
064000          BCZ     1,CHARAC                                     R100
064100          HLT     3CA,0,1                                      R100
064200          BCZ     1,CHECK                                      R100
064300          HLT                                                  R100
064400          BCZ     1,CLASS                                      R100
064500          HLT                                                  R100
064600          BCZ     1,CLOCK-                                     R100
064700          HLT     A4C,0,1                                      R100
064800          BCZ     1,CLOSE                                      R100
064900          HLT                                                  R100
065000          BCZ     1,COBOL                                      R100
065100          HLT                                                  R100
065200          BCZ     1,COMP-1                                     R100
065300          HLT                                                  R100
065400          BCZ     1,COMP-2                                     R100
065500          HLT                                                  R100
065600          BCZ     1,COMPUT                                     R100
065700          HLT     A5C,0,2                                      R100
065800          BCZ     1,COMPUT                                     R100
065900          HLT     A6C,0,2                                      R100
066000          BCZ     1,COMPUT                                     R100
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066100          HLT     A7C,0,1                                         R100
066200          BCZ     1,CONSTA                                        R100
066300          HLT     A8C,0,1                                         R100
066400          BCZ     1,CONFIG                                        R100
066500          HLT     A9C,0,2                                         R100
066600          BCZ     1,CONTAI                                        R100
066700          HLT     A10C,0,1                                        R100
066800          BCZ     1,CONTRO                                        R100
066900          HLT     A11C,0,1                                        R100
067000          BCZ     1,COPY                                          R100
067100          HLT                                                     R100
067200          BCZ     1,CORRES                                        R100
067300          HLT     A12C,0,2                                        R100
067400A1D       BCZ     1,DATA                                          R100
067500          HLT                                                     R100
067600          BCZ     1,DATE-W                                        R100
067700          HLT     A2D,0,1                                         R100
067800          BCZ     1,DECLAR                                        R100
067900          HLT     A3D,0,1                                         R100
068000          BCZ     1,DEFINE                                        R100
068100          HLT                                                     R100
068200          BCZ     1,DEPEND                                        R100
068300          HLT     A4D,0,1                                         R100
068400          BCZ     1,DIGIT                                         R100
068500          HLT                                                     R100
068600          BCZ     1,DIGITS                                        R100
068700          HLT                                                     R100
068800          BCZ     1,DISPLA                                        R100
068900          HLT     A5D,0,1                                         R100
069000          BCZ     1,DIVIDE                                        R100
069100          HLT                                                     R100
069200          BCZ     1,DIVIDE                                        R100
069300          HLT     A6D,0,1                                         R100
069400          BCZ     1,DIVISI                                        R100
069500          HLT     A7D,0,1                                         R100
069600          BCZ     1,DOLLAR                                        R100
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069700          HLT                                                 R100
069800A1E       BCZ     1,ELSE                                      R100
069900          HLT                                                 R100
070000A10E      BCZ     1,END                                       R100
070100          HLT                                                 R100
070200          BCZ     1,ENDING                                    R100
070300          HLT                                                 R100
070400          BCZ     1,ENDING                                    R100
070500          HLT     A2E,0,2                                     R100
070600          BCZ     1,ENDING                                    R100
070700          HLT     A3E,0,2                                     R100
070800          BCZ     1,END-OF                                    R100
070900          HLT     A4E,0,1                                     R100
071000          BCZ     1,END-OF                                    R100
071100          HLT     A5E,0,1                                     R100
071200          BCZ     1,ENTER                                     R100
071300          HLT                                                 R100
071400          BCZ     1,ENVIRO                                    R100
071500          HLT     A6E,0,1                                     R100
071600          BCZ     1,EQUAL                                     R100
071700          HLT                                                 R100
071800          BCZ     1,EQUALS                                    R100
071900          HLT                                                 R100
072000          BCZ     1,ERROR                                     R100
072100          HLT                                                 R100
072200          BCZ     1,EVERY                                     R100
072300          HLT                                                 R100
072400          BCZ     1,EXAMIN                                    R100
072500          HLT     A7E,0,1                                     R100
072600          BCZ     1,EXCEED                                    R100
072700          HLT     A8E,0,1                                     R100
072800          BCZ     1,EXIT                                      R100
072900          HLT                                                 R100
073000          BCZ     1,EXPONE                                    R100
073100          HLT     A9E,0,2                                     R100
073200A1F       BCZ     1,FD                                        R100
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073300          HLT                                                  R100
073400          BCZ     1,FOR                                        R100
073500          HLT                                                  R100
073600          BCZ     1,FILE                                       R100
073700          HLT                                                  R100
073800          BCZ     1,FILE-C                                     R100
073900          HLT     A2F,0,1                                      R100
074000          BCZ     1,FILLER                                     R100
074100          HLT                                                  R100
074200          BCZ     1,FILLIN                                     R100
074300          HLT     A3F,0,1                                      R100
074400          BCZ     1,FIRST                                      R100
074500          HLT                                                  R100
074600          BCZ     1,FLEXO                                      R100
074700          HLT     A4F,0,1                                      R100
074800          BCZ     1,FLOAT                                      R100
074900          HLT                                                  R100
075000          BCZ     1,FORMAT                                     R100
075100          HLT                                                  R100
075200          BCZ     1,FROM                                       R100
075300          HLT                                                  R100
075400A1G       BCZ     1,GIVING                                     R100
075500          HLT                                                  R100
075600          BCZ     1,GO                                         R100
075700          HLT                                                  R100
075800          BCZ     1,GREATE                                     R100
075900          HLT     A2G,0,1                                      R100
076000A1H       BCZ     1,HALF-P                                     R100
076100          HLT     A5H,0,1                                      R100
076200          BCZ     1,HASH-T                                     R100
076300          HLT     A2H,0,1                                      R100
076400          BCZ     1,HIGH-V                                     R100
076500          HLT     A3H,0,1                                      R100
076600          BCZ     1,HIGH-V                                     R100
076700          HLT     A4H,0,1                                      R100
076800          BCZ     1,HEADER                                     R100
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076900          HLT
077000A1I       BCZ     1,I-O-CO                                        R100
077100          HLT     A2I,0,1                                         R100
077200          BCZ     1,IF                                            R100
077300          HLT                                                     R100
077400          BCZ     1,IN                                            R100
077500          HLT                                                     R100
077600          BCZ     1,INCLUD                                        R100
077700          HLT     A3I,0,1                                         R100
077800          BCZ     1,INPUT                                         R100
077900          HLT                                                     R100
078000          BCZ     1,INPUT-                                        R100
078100          HLT     A4I,0,1                                         R100
078200          BCZ     1,INTO                                          R100
078300          HLT                                                     R100
07840051        BCZ     1,IS                                            R100
078500          HLT                                                     R100
078600A1J       BCZ     1,JUSTIF                                        R100
078700          HLT     A2J,0,1                                         R100
078800A1L       BCZ     1,LABEL                                         R100
078900          HLT                                                     R100
079000          BCZ     1,LABELL                                        R100
079100          HLT     A2L,0,2                                         R100
079200          BCZ     1,LEADIN                                        R100
079300          HLT     A3L,0,1                                         R100
079400          BCZ     1,LEAVIN                                        R100
079500          HLT     A4L,0,1                                         R100
079600          BCZ     1,LEFT                                          R100
079700          HLT                                                     R100
079800          BCZ     1,LESS                                          R100
079900          HLT                                                     R100
080000          BCZ     1,LIBRAR                                        R100
080100          HLT     A5L,0,1                                         R100
080200          BCZ     1,LINES                                         R100
080300          HLT                                                     R100
080400          BCZ     1,LOCATI                                        R100
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080500          HLT     A6L,0,1                                 R100
080600          BCZ     1,LOCK                                  R100
080700          HLT                                             R100
080800          BCZ     1,LOW-VA                                R100
080900          HLT     A7L,0,1                                 R100
081000          BCZ     1,LOW-VA                                R100
081100          HLT     A8L,0,1                                 R100
081200          BCZ     1,LOWER-                                R100
081300          HLT     A9L,0,1                                 R100
081400          BCZ     1,LOWER-                                R100
081500          HLT     A10L,0,1                                R100
081600A1M       BCZ     1,MEMORY                                R100
081700          HLT                                             R100
081800          BCZ     1,MEMORY                                R100
081900          HLT     A2M,0,1                                 R100
082000          BCZ     1,MEMORY                                R100
082100          HLT     A3M,0,2                                 R100
082200          BCZ     1,MINUS                                 R100
082300          HLT                                             R100
082400          BCZ     1,MODE                                  R100
082500          HLT                                             R100
082600          BCZ     1,MODULE                                R100
082700          HLT     A4M,0,1                                 R100
082800          BCZ     1,MOVE                                  R100
082900          HLT                                             R100
083000          BCZ     1,MULTIP                                R100
083100          HLT     A5M,0,1                                 R100
083200          BCZ     1,MULTIP                                R100
083300          HLT     A6M,0,1                                 R100
083400          BCZ     1,MULTIP                                R100
083500          HLT     A7M,0,1                                 R100
083600A1N       BCZ     1,NEGATI                                R100
083700          HLT     A2N,0,1                                 R100
083800          BCZ     1,NEXT                                  R100
083900          HLT                                             R100
084000          BCZ     1,NO                                    R100
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084100          HLT                                                  R100
084200          BCZ     1,NO-MEM                                     R100
084300          HLT     A3N,0,2                                      R100
084400          BCZ     1,NOT                                        R100
084500          HLT                                                  R100
084600          BCZ     1,NOTE                                       R100
084700          HLT                                                  R100
084800          BCZ     1,NUMERI                                     R100
084900          HLT     A4N,0,1                                      R100
085000A10       BCZ     1,OBJECT                                     R100
085100          HLT     A20,0,2                                      R100
085200          BCZ     1,OBJECT                                     R100
085300          HLT     A30,0,2                                      R100
085400          BCZ     1,OCCURS                                     R100
085500          HLT                                                  R100
085600          BCZ     1,OF                                         R100
085700          HLT                                                  R100
08580080        BCZ     1,OFF                                        R100
085900          HLT                                                  R100
086000          BCZ     1,OMITTE                                     R100
086100          HLT     A40,0,1                                      R100
08620070        BCZ     1,ON                                         R100
086300          HLT                                                  R100
086400          BCZ     1,ON-LIN                                     R100
086500          HLT     A90,0,2                                      R100
086600          BCZ     1,OPEN                                       R100
086700          HLT                                                  R100
086800          BCZ     1,OPTION                                     R100
086900          HLT     A50,0,1                                      R100
087000          BCZ     1,OR                                         R100
087100          HLT                                                  R100
087200          BCZ     1,OTHERW                                     R100
087300          HLT     A60,0,1                                      R100
087400          BCZ     1,OUTPUT                                     R100
087500          HLT                                                  R100
087600A1P       BCZ     1,PAGE                                       R100
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087700          HLT                                                  R100
087800          BCZ     1,PAPER-                                     R100
087900          HLT     A13P,0,2                                     R100
088000          BCZ     1,PAPER-                                     R100
088100          HLT     A14P,0,2                                     R100
088200          BCZ     1,PERFOR                                     R100
088300          HLT     A2P,0,1                                      R100
088400          BCZ     1,PICTUR                                     R100
088500          HLT     A3P,0,1                                      R100
088600          BCZ     1,PLACES                                     R100
088700          HLT                                                  R100
088800          BCZ     1,PLUS                                       R100
088900          HLT                                                  R100
089000          BCZ     1,POINT                                      R100
089100          HLT                                                  R100
089200          BCZ     1,POSITI                                     R100
089300          HLT     A4P,0,1                                      R100
089400          BCZ     1,POSITI                                     R100
089500          HLT     A5P,0,1                                      R100
089600          BCZ     1,PREPAR                                     R100
089700          HLT     A6P,0,1                                      R100
089800          BCZ     1,PRIORI                                     R100
089900          HLT     A7P,0,1                                      R100
090000          BCZ     1,PROCED                                     R100
090100          HLT     A8P,0,1                                      R100
090200          BCZ     1,PROCEE                                     R100
090300          HLT     A9P,0,1                                      R100
090400          BCZ     1,PROTEC                                     R100
090500          HLT     A10P,0,1                                     R100
090600          BCZ     1,PROTEC                                     R100
090700          HLT     A11P,0,1                                     R100
090800          BCZ     1,PURGE-                                     R100
090900          HLT     A12P,0,1                                     R100
091000A1Q        BCZ     1,QUOTE                                      R100
091100          HLT                                                  R100
091200A1R        BCZ     1,RANGE                                      R100
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091300          HLT                                                  R100
091400          BCZ     1,READ                                       R100
091500          HLT                                                  R100
091600          BCZ     1,RECORD                                     R100
091700          HLT                                                  R100
091800          BCZ     1,RECORD                                     R100
091900          HLT     A2R,0,1                                      R100
092000          BCZ     1,RECORD                                     R100
092100          HLT     A3R,0,1                                      R100
092200          BCZ     1,RECORD                                     R100
092300          HLT     A4R,0,1                                      R100
092400          BCZ     1,REDEFI                                     R100
092500          HLT     A5R,0,1                                      R100
092600          BCZ     1,REEL                                       R100
092700          HLT                                                  R100
092800          BCZ     1,REEL-N                                     R100
092900          HLT     A6R,0,1                                      R100
093000          BCZ     1,RENAMI                                     R100
093100          HLT     A7R,0,1                                      R100
093200          BCZ     1,REPLAC                                     R100
093300          HLT     A8R,0,1                                      R100
093400          BCZ     1,RERUN                                      R100
093500          HLT                                                  R100
093600          BCZ     1,RESERV                                     R100
093700          HLT     A9R,0,1                                      R100
093800          BCZ     1,REVERS                                     R100
093900          HLT     A10R,0,1                                     R100
094000          BCZ     1,REWIND                                     R100
094100          HLT                                                  R100
094200          BCZ     1,RIGHT                                      R100
094300          HLT                                                  R100
094400          BCZ     1,ROUNDE                                     R100
094500          HLT     A11R,0,1                                     R100
094600          BCZ     1,RUN                                        R100
094700          HLT                                                  R100
094800A1S       BCZ     1,SAME                                       R100
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094900      HLT                R100
095000      BCZ   1,SECTIO     R100
095100      HLT   A2S,0,1      R100
095200      BCZ   1,SELECT     R100
095300      HLT                R100
095400      BCZ   1,SENTEN     R100
095500      HLT   A3S,0,1      R100
095600      BCZ   1,SENTIN     R100
095700      HLT   A4S,0,1      R100
095800      BCZ   1,SEQUEN     R100
095900      HLT   A5S,0,1      R100
096000      BCZ   1,SIGN       R100
096100      HLT                R100
096200      BCZ   1,SIGNED     R100
096300      HLT                R100
096400      BCZ   1,SIZE       R100
096500      HLT                R100
096600      BCZ   1,SOURCE     R100
096700      HLT   A6S,0,1      R100
096800      BCZ   1,SPACE      R100
096900      HLT                R100
097000      BCZ   1,SPACES     R100
097100      HLT                R100
097200      BCZ   1,SPECIA     R100
097300      HLT   A7S,0,2      R100
097400      BCZ   1,STANDA     R100
097500      HLT   A8S,0,1      R100
09760013S   BCZ   1,STATUS     R100
097700      HLT                R100
097800      BCZ   1,STOP       R100
097900      HLT                R100
098000      BCZ   1,SUBTRA     R100
098100      HLT   A9S,0,1      R100
098200      BCZ   1,SUPERV     R100
098300      HLT   A10S,0,1     R100
098400      BCZ   1,SUPPRE     R100
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098500          HLT     A11S,0,1                                    R100
098600          BCZ     1,SYNCHR                                    R100
098700          HLT     A12S,0,1                                    R100
098800A1T       BCZ     1,TALLY                                     R100
098900          HLT                                                 R100
099000          BCZ     1,TALLYI                                    R100
099100          HLT     A2T,0,1                                     R100
099200          BCZ     1,TAPE                                      R100
099300          HLT                                                 R100
099400          BCZ     1,TEST-P                                    R100
099500          HLT     A3T,0,1                                     R100
099600          BCZ     1,THAN                                      R100
099700          HLT                                                 R100
099800          BCZ     1,THEN                                      R100
099900          HLT                                                 R100
100000          BCZ     1,THROUG                                    R100
100100          HLT     A4T,0,1                                     R100
100200          BCZ     1,THRU                                      R100
100300          HLT                                                 R100
100400          BCZ     1,TIMES                                     R100
100500          HLT                                                 R100
100600          BCZ     1,TO                                        R100
100700          HLT                                                 R100
100800          BCZ     1,TRAILE                                    R100
100900          HLT     A5T,0,1                                     R100
101000          BCZ     1,TYPE                                      R100
101100          HLT                                                 R100
101200A1U       BCZ     1,UNEQUA                                    R100
101300          HLT     A2U,0,1                                     R100
101400          BCZ     1,UPPER-                                    R100
101500          HLT     A3U,0,1                                     R100
101600          BCZ     1,UPPER-                                    R100
101700          HLT     A4U,0,1                                     R100
101800          BCZ     1,UNTIL                                     R100
101900          HLT                                                 R100
102000          BCZ     1,UPON                                      R100
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102100          HLT                                                  R100
102200          BCZ     1,USAGE                                      R100
102300          HLT                                                  R100
102400          BCZ     1,USE                                        R100
102500          HLT                                                  R100
102600A1V       BCZ     1,VALUE                                      R100
102700          HLT                                                  R100
102800          BCZ     1,VARYIN                                     R100
102900          HLT     A2V,0,1                                      R100
103000A1W       BCZ     1,WHEN                                       R100
103100          HLT                                                  R100
103200          BCZ     1,WITH                                       R100
103300          HLT                                                  R100
103400          BCZ     1,WORDS                                      R100
103500          HLT                                                  R100
103600          BCZ     1,WORD-S                                     R100
103700          HLT     A3W,0,3                                      R100
103800          BCZ     1,WORKIN                                     R100
103900          HLT     A2W,0,2                                      R100
104000          BCZ     1,WRITE                                      R100
104100          HLT                                                  R100
104200A1Z       BCZ     1,ZERO                                       R100
104300          HLT                                                  R100
104400          BCZ     1,ZEROES                                     R100
104500          HLT                                                  R100
104600          BCZ     1,ZEROS                                      R100
104700          HLT                                                  R100
104800A2A       BCZ     1,S                                          R100
104900A3A       BCZ     1,ING                                        R100
105000A4A       BCZ     1,ETIC                                       R100
105100A5A       BCZ     1,UMERIC                                     R100
105200A6A       BCZ     1,ATE                                        R100
105300A7A       BCZ     1,LATOR                                      R100
105400A3B       BCZ     4,ING-FILE-LABEL                             R100
105500A4B       BCZ     4,ING-TAPE-LABEL                             R100
105600A5B       BCZ     1,COUNT                                      R100
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1057002CA     BCZ     1,TER                                   R100
1058003CA     BCZ     1,TERS                                  R100
105900A4C     BCZ     1,UNITS                                 R100
106000A5C     BCZ     2,ATIONAL-1                             R100
106100A6C     BCZ     2,ATIONAL-2                             R100
106200A7C     BCZ     1,E                                     R100
106300A8C     BCZ     1,NT                                    R100
106400A9C     BCZ     2,URATION                               R100
106500A10C    BCZ     1,NS                                    R100
106600A11C    BCZ     1,L                                     R100
106700A12C    BCZ     2,PONDING                               R100
106800A13C    BCZ     1,EADER                                 R100
106900A14C    BCZ     1,UNCH                                  R100
107000A2D     BCZ     1,RITTEN                                R100
107100A3D     BCZ     1,ATIVES                                R100
107200A5D     BCZ     1,Y                                     R100
107300A6D     BCZ     1,D                                     R100
107400A7D     BCZ     1,ON                                    R100
107500A2E     BCZ     2,-FILE-LABEL                           R100
107600A3E     BCZ     2,-TAPE-LABEL                           R100
107700A4E     BCZ     1,-FILE                                 R100
107800A5E     BCZ     1,-TAPE                                 R100
107900A6E     BCZ     1,NMENT                                 R100
108000A9E     BCZ     2,NTIATED                               R100
108100A2F     BCZ     1,ONTROL                                R100
108200A3F     BCZ     1,G                                     R100
108300A4F     BCZ     1,RITER                                 R100
108400A2G     BCZ     1,R                                     R100
108500A2H     BCZ     1,OTAL                                  R100
108600A3H     BCZ     1,ALUE                                  R100
108700A4H     BCZ     1,ALUES                                 R100
108800A5H     BCZ     1,AGE                                   R100
108900A2I     BCZ     1,NTROL                                 R100
109000A4I     BCZ     1,OUTPUT                                R100
109100A2J     BCZ     1,IED                                   R100
109200A2L     BCZ     2,ED-ITEM                               R100
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109300A7L    BCZ    1,LUE                                    R100
109400A8L    BCZ    1,LUES                                   R100
109500A9L    BCZ    1,BOUND                                  R100
109600A10L   BCZ    1,BOUNDS                                 R100
109700A2M    BCZ    1,-DUMP                                  R100
109800A3M    BCZ    2,-DUMP-KEY                              R100
109900A5M    BCZ    1,LE                                     R100
110000A6M    BCZ    1,LIED                                   R100
110100A7M    BCZ    1,LY                                     R100
110200A2N    BCZ    1,VE                                     R100
110300A3N    BCZ    2,ORY-DUMP                               R100
110400A4N    BCZ    1,C                                      R100
110500A2O    BCZ    2,-COMPUTER                              R100
110600A3O    BCZ    2,-PROGRAM                               R100
110700A5O    BCZ    1,AL                                     R100
110800A6O    BCZ    1,ISE                                    R100
110900A9O    BCZ    2,E-PRINTER                              R100
111000A2P    BCZ    1,M                                      R100
111100A6P    BCZ    1,ED                                     R100
111200A7P    BCZ    1,TY                                     R100
111300A8P    BCZ    1,URE                                    R100
111400A10P   BCZ    1,T                                      R100
111500A11P   BCZ    1,TION                                   R100
111600A12P   BCZ    1,DATE                                   R100
111700A13P   BCZ    2,TAPE-PUNCH                             R100
111800A14P   BCZ    2,TAPE-READER                            R100
111900A2R    BCZ    1,-COUNT                                 R100
112000A5R    BCZ    1,NES                                    R100
112100A6R    BCZ    1,UMBER                                  R100
112200A7R    BCZ    1,NG                                     R100
112300A2S    BCZ    1,N                                      R100
112400A3S    BCZ    1,CE                                     R100
112500A4S    BCZ    1,EL                                     R100
112600A5S    BCZ    1,CED                                    R100
112700A7S    BCZ    2,L-NAMES                                R100
112800A8S    BCZ    1,RD                                     R100
```

```
112900A9S   BCZ   1,CT                                          R100
113000A10S  BCZ   1,ISOR                                        R100
113100A11S  BCZ   1,SS                                          R100
113200A12S  BCZ   1,ONIZED                                      R100
113300A2T   BCZ   1,NG                                          R100
113400A3T   BCZ   1,ATTERN                                      R100
113500A4T   BCZ   1,H                                           R100
113600A2W   BCZ   2,G-STORAGE                                   R100
113700A3W   BCZ   3,WITCH-REGISTER                              R100
113800BSP   BCZ   1,BBEE                                        R100
091000A     MOV   IR3,J10          SAVE IR3 AND 4               R110
091100      MOV   IR4,J11                                       R110
091200      MVZ   IR1              CLEAR IR1                    R110
091210      MOV   =1,IR2                                        R110
091212      RPT   4,0,0                                         R110
091214      MVZ   TB00A                                         R110
091600      LOD   SAV3,0,IR3                                    R110
091700      LOD   SAV4,0,IR4                                    R110
091800      MOV   PCS,SAPCS        SAVE PCS                     R110
091900      MOV   =30,TB00B                                     R110
092000      MVZ   TB00C            SET TO ZERO                  R110
092200      MVZ   TB00W                                         R110
092300      MOV   =1,CNT2                                       R110
092400      SNR   *+1,0,00F0C           PERIOD                  R110
092500      SNR   *+1,0,01F0C           COMMA                   R110
092600      SNR   *+1,0,04F0C     CONTINUATION SWITCH           R110
092700      SNR   *+1,0,07F0C      RESET NON NUMERIC SWITCH     R110
092800A5    LDQ   LA00A,3          PICK UP WORD                 R110
092900A13   CLA   LA00T            IS THIS WORD PROCESSED      R110
093000      TRZ   A1                                            R110
093100      SUB   =1,0,3           DECREASE BY ONE              R110
093200      STR   LA00T                                         R110
093300      CLA   ZERO             CLEAR ACC                    R110
093400      SLL   6,0,3                                         R110
093500      STR   IR2              CHARACTER TO INDEX 2         R110
093600      TRU   TA00A,2          TEST CHARACTER               R110
```

```
093700A1    CLA     =6              SET CHARACTER COUNT FOR NEW WORD    R110
093800      STR     LA00T           TO SIX                              R110
093900      TRX     A5,3,1                                              R110
            SEN     A7,0,02F0C
094900      ADB     LL00C,0,1       UPDATE LINE COUNT                   R110
095000      LDQ     BSP                                                 R110
095100      SLL     12,0,1                                              R110
095200      LDQ     =/77777777                                          R110
095300      MSK     LL00A+14                                            R110
095400      TRL     WR,0,TP3                                            R110
            PRE     LL00A,0,LF0N
095600      PZE     LL00W,LL00C                                         R110
      A7    TRL     RD,0,SP0        LINE ALL PROCESSED
096100      HLT     LL00A                                               R110
096200      HLT                                                         R110
096300      MOV     =1,IR2          SAVE INPUT LINE                     R110
096400      RPT     13,0,1          X                                   R110
096500      MOV     LL00A+1,LA00A                                       R110
096600      LDQ     =/7777          SPACE FILL LAST                     R110
096700      CLA     =/0505          TWO CHARACTERS                      R110
096800      MSK     LA00A+12                                            R110
096900      MOV     =6,CNT          COLUMN COUNT                        R110
097000      MVZ     CNT2                                                R110
            SEN     A24,0,09F0C     ARE WE IN SPECIAL MODE
            MOV     =-1,LL00B
097300A23   CLA     LA00A           PICK UP SEQUENCE NUMBER             R110
            TRC     =/050505050505
            TRU     *+3
            TRU     *+2
            TRU     A8
097400      TRC     LA00C           COMPARE WITH LAST NUMBER            R110
097500      TRL     ERRB,2,FG4                                          R110
097600      TRU     A8              SERIAL NUMBER CHECKS                R110
097700      TRU     *-2                                                 R110
097800A8    STR     LA00C           STORE NEW SERIAL NUMBER             R110
097900A24   LSX     1,3,12          SET INDEX REGIATERS                 R110
```

```
098000          LDQ     LA00A+1          PICK UP SECOND WORD                R110
098010          SNR     *+1,0,04F0C      RESET CONTINUATION SWITCH          R110
098100          CLA     ZERO             CLEAR ACC                          R110
098200          SLL     6,0,3            GET FIRST CHARACTER                R110
                SEN     A25,0,09F0C      ARE WE IN SPECIAL MODE
098300          SUB     =/05,0,1         IS THERE A SPACE IN 7              R110
                TRZ     A22B
098500          ADD     =/05,0,1         NO                                 R110
098600          SUB     =/41,0,1         IS THERE A - IN 7                  R110
098700          TRZ     *+2              YES                                R110
098800          TRU     A22A             NO                                 R110
099000          SNR     *+1,0,03F0C      RESET SPACE FLIP-FLOP              R110
                ADB     LL00B,0,1
099050          CLA     CNT              ADJUST COLUMN COUNT                R110
099055          ADD     =1,0,1                                              R110
099060          STR     CNT                                                 R110
099100          SNS     A25,0,04F0C      CONTINUATION BIT PRESENT           R110
099200          HLT     H1                                                  R110
099220A22A      ADD     =/41,0,1                                            R110
099225          STR     IR2                                                 R110
099230          MOV     IR1,ERR2                                            R110
099235          TRL     ERR10,1,FG10                                        R110
099240          TRU     A14                                                 R110
      A22B      CLA     TB00C            TEST CHARACTER COUNT
                TRZ     *+2
                TRU     A22
                ADB     LL00B,0,1        CARD WORD COUNT
099300A22       CLA     TB00C             TEST CHARACTER COUNT              R110
099400          TRZ     A5                GET NEXT CHARACTER                R110
099500          MOV     IR3,SAV3                                            R110
099600          MOV     IR4,SAV4                                            R110
099700          CLA     TB00B             CHECK SHIFT COUNT                 R110
099800          TRC     =30                                                 R110
099900          TRU     *+3                                                 R110
100000          TRL     ERR,1,FG2                                           R110
100100          TRU     *+2                                                 R110
```

```
100200      ADB     TB00W,0,1          UPDATE WORD COUNT                    R110
100300      MOV     J10,IR3            RELOAD IR 3 AND 4                    R110
100400      MOV     J11,IR4            X                                    R110
            ADB     LL00B,0,1         CARD WORD COUNT
100500      CLA     TB00A                    PICK UP FIRST SIX CHARACTERS   R110
100600      LOD     SAPCS,0,PCT        RETURN                               R110
100700A25   CLA     LA00T              DECREASE CHARACTER COUNT BY ONE      R110
100800      SUB     =1,0,3             AND RETURN TO GET                    R110
100900      TRU     A13+1              NEXT CHARACTER                       R110
101000A12   TRL     ERR,1,FG11                                              R110
101100      TRU     A14                                                     R110
101190A6    SNR     A14,0,03F0C                                             R110
101200      MOV     IR1,ERR2                                                R110
101300      TRL     ERR10,1,FG1                                             R110
101400A26   SNR     *+1,0,04F0C       RESET CONTINUATION SWITCH             R110
101500      SNR     A14,0,03F0C                                             R110
101600      SNS     A4,0,07F0C        SET NON-NUMERIC SWITCH                R110
101700A4    CLA     CNT                UP DATE COLUMN COUNT                 R110
101800      SNR     *+1,0,04F0C       RESET CONTINUATION SWITCH             R110
101900      ADD     =1,0,1             X                                    R110
102000      STR     CNT                X                                    R110
102100      SEN     A12,0,00F0C        IS THERE A PERIOD                    R110
102200      SEN     A12,0,01F0C        IS THERE A COMMA                     R110
102300      SNR     A14,0,03F0C        SPACE HAS BEEN FOUND                 R110
102400      CLA     TB00C              UPDATE CHARACTER                     R110
102500      ADD     =1,0,3                                                  R110
102600      STR     TB00C                                                   R110
102700      SUB     =31,0,3            MORE THAN 30 CHARACTERS              R110
102800      TRN     A15                NO                                   R110
102900      TRL     ERRB,2,FG1         ERROR FIND END OF                    R110
102910      TRU     A13                WORD                                 R110
102990A3    CLA     CNT                ADJUST COLUMN COUNT                  R110
102993      ADD     =1,0,1                                                  R110
102997      STR     CNT                                                     R110
            SEN     A3AA,0,09F0C       SPECIAL MODE
103000      SEN     A25,0,04F0C        SENSE CONTINUATION SWITCH            R110
```

```
103100          CLA     TB00C           SPACE TEST CHARACTER COUNT      R110
103200          TRZ     A13                                             R110
103300          SEN     A18,0,00F0C     DOES SPACE FOLLOW PERIOD        R110
103400          SEN     A18,0,01F0C     OR COMMA                        R110
103500          SNS     A13,0,03F0C     LOOK FOR NEXT CHARACTER         R110
103600          TRU     A13                                             R110
      A3AA      CLA     TB00C           GET CHARACTER COUNT
                TRZ     *+2
                TRU     A18             RETURN NOT BLANK
                CLA     CNT
                TRC     =76
                TRU     A3
                HLT
                MOV     SAPCS,PCT
103700A14       CLA     IR2             REPLACE CHARACTER               R110
103800          SRL     6               AND                             R110
103900          CLA     LA00T           UPDATE                          R110
104000          ADD     =1,0,3          COUNTER                         R110
104100          STR     LA00T                                           R110
104200A18       CLA     QRG             REPLACE WORD IN                 R110
104300          STR     LA00A,3         BUFFER                          R110
104400          TRU     A22             RETURN                          R110
104490A2        SNR     A14,0,03F0C                                     R110
104500          MOV     IR1,ERR2                                        R110
104600          TRL     ERR10,1,FG1                                     R110
104610          TRU     A26                                             R110
104700A11       SNS     *+2,0,01F0C     COMMA FOUND                     R110
104800          TRL     ERRB,2,FG11                                     R110
104900          SNR     A13A,0,04F0C    RESET CONTINUATION SWITCH       R110
105000A13A      CLA     CNT              UPDATE COLUMN COUNT            R110
105100          ADD     =1,0,1           X                              R110
105200          STR     CNT              X                              R110
105300          TRU     A13                                             R110
105400A9        SNS     *+2,0,00F0C      PERIOD FOUND                   R110
105500          TRL     ERRB,2,FG11                                     R110
105600          SNR     A13A,0,04F0C    RESET CONTINUATION SWITCH       R110
```

```
105700          TRU     A13A                                            R110
105800A15       CLA     TB00B           PACK CHARACTER                  R110
105900          RPA     A16                                             R110
106000          CLA     IR2                                             R110
106100A16       SHL     **,0,1                                          R110
106200          ADD     TB00A,1,1                                       R110
106300          STR     TB00A,1                                         R110
106400          CLA     TB00B           REDUCE SHIFT                    R110
106500          SUB     =6,0,3          COUNT                           R110
106600          TRN     A17                                             R110
106700          STR     TB00B           GET NEXT CHARACTER              R110
106800          TRU     A13                                             R110
106900A17       CLA     IR1             UPDATE INDEX REGISTER           R110
107000          ADD     =1,0,3          X                               R110
107100          STR     IR1             X                               R110
107200          MOV     =30,TB00B       RESET SHIFT COUNT               R110
107300          CLA     TB00W           UPDATE WORD                     R110
107400          ADD     =1,0,1          COUNT                           R110
107500          STR     TB00W           X                               R110
107800          TRU     A13                                             R110
107900TA00A     TRU     A6              00    MS                        R110
108000          TRU     A6              01    UC                        R110
108100          TRU     A6              02    LC                        R110
108200          TRU     A6              03    TB                        R110
108300          TRU     A6              04    CR                        R110
108400A19       TRU     A3              05    SPACE                     R110
108500          TRU     A26                   06    A                   R110
108600          TRU     A26                   07    B                   R110
108700          TRU     A26                   10    C                   R110
108800          TRU     A26                   11    D                   R110
108900          TRU     A26                   12    E                   R110
109000          TRU     A26                   13    F                   R110
109100          TRU     A26                   14    G                   R110
109200          TRU     A26                   15    H                   R110
109300          TRU     A26                   16    I                   R110
109400          TRU     A26                   17    J                   R110
```

```
109500          TRU     A26                     20  K                   R110
109600          TRU     A26                     21  L                   R110
109700          TRU     A26                     22  M                   R110
109800          TRU     A26                     23  N                   R110
109900          TRU     A26                     24  O                   R110
110000          TRU     A26                     25  P                   R110
110100          TRU     A26                     26  Q                   R110
110200          TRU     A26                     27  R                   R110
110300          TRU     A26                     30  S                   R110
110400          TRU     A26                     31  T                   R110
110500          TRU     A26                     32  U                   R110
110600          TRU     A26                     33  V                   R110
110700          TRU     A26                     34  W                   R110
110800          TRU     A26                     35  X                   R110
110900          TRU     A26                     36  Y                   R110
111000          TRU     A26                     37  Z                   R110
111100          TRU     A2              40      RP                      R110
111200A20       TRU     A4              41      -                       R110
111300          TRU     A2              42      +                       R110
111400          TRU     A2              43      LESS                    R110
111500          TRU     A2              44      =                       R110
111600          TRU     A2              45      GREATER                 R110
111700          TRU     A4              46      MINUS                   R110
111800          TRU     A2              47      DOLLAR SIGN             R110
111900          TRU     A2              50      *                       R110
112000          TRU     A2              51      LP                      R110
112100          TRU     A2              52      QUOTE                   R110
112200          TRU     A2              53                              R110
112300          TRU     A2              54      QUESTION                R110
112400          TRU     A2              55                              R110
112500          TRU     A11             56      ,                       R110
112600          TRU     A6              57      STOP CODE               R110
112700          TRU     A4              60      0                       R110
112800          TRU     A4              61      1                       R110
112900          TRU     A4              62      2                       R110
113000          TRU     A4              63      3                       R110
```

```
113100          TRU     A4
113200          TRU     A4
113300          TRU     A4
113400          TRU     A4
113500          TRU     A4
113600          TRU     A4
113700          TRU     A2
113800          TRU     A11
113900          TRU     A2
114000          TRU     A9
114100          TRU     A6
114200          TRU     A6
114300SAV3      OCT     0
      SAV4      OCT     0
137000SAPCS     HLT
114500K         TRS
114600K8        TRS
114700K12       TRS
114800CNT       HLT
114900CNT1      HLT
115000CNT2      HLT
115100CK1       HLT
115200CK        CLA     CNT
115300          SUB     TB00C,0,1
115400          TRC     =6
115500          TRU     CK2
115600          TRU     *+1
115700          ADB     PCS,0,1
115800          TRS
115900CK2       MOV     PCS,CK1
116000          TRL     ERR,1,FG10
116100          MOV     CK1,PCT
139700SCAN      LSX     0,3,7777
139800SCN1      TRL     A
139900          TRL     CK
140000          TRL     K12
```

```
64    4
65    5
66    6
67    7
70    8
71    9
72    APOS
73    '
74    /
75    .
76    SPECIAL
77    CODE DELETE

PUT NAME IN COLUMN 8

MINOR ERROR
```

```
R110
R110
R110
R110
R110
R110
R110
R110
R110
R110
R110
R100
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R110
R100
R100
R100
R100
```

```
140100SCAN9  CLA   TB00A                PICK UP FIRST SIX CHARACTERS   R100
140400SCAN6  TRC   ID,3                                               R100
140500SCAN7  TRU   SCAN1                                              R100
140600       TRU   SCAN1                                              R100
140700SCAN8  CLA   ID+1,3               PICK UP SECOND WORD            R100
140800       TRN   SCAN2                COMPLETE COMPARISION           R100
140900       RPA   PCT                  TRANSFER TO - MATCH            R100
141000SCAN1  CLA   ID+2,3               PICK UP THIRD WORD             R100
141100       RPA   PCT                  MATCH                          R100
141500H1     TRX   SCN1,3,3                                           R100
141600H2     TRX   SCN1,3,6                                           R100
141700H3     TRX   SCN1,3,9                                           R100
141800H4     TRX   SCN1,3,12                                          R100
141900H5     TRX   SCN1,3,15                                          R100
142000H6     TRX   SCN1,3,18                                          R100
142100H7     TRX   SCN1,3,21                                          R100
142200H8     TRX   SCN1,3,24                                          R100
142300H9     TRX   SCN1,3,27                                          R100
142400H10    TRX   SCN1,3,30                                          R100
142500H11    TRX   SCN1,3,33                                          R100
142600H12    TRX   SCN1,3,36                                          R100
142700H1A    TRX   SCAN9,3,3                                          R100
142800H2A    TRX   SCAN9,3,6                                          R100
142900H3A    TRX   SCAN9,3,9                                          R100
143000H4A    TRX   SCAN9,3,12                                         R100
143100H5A    TRX   SCAN9,3,15                                         R100
143200H6A    TRX   SCAN9,3,18                                         R100
143300H7A    TRX   SCAN9,3,21                                         R100
143400H8A    TRX   SCAN9,3,24                                         R100
143500H9A    TRX   SCAN9,3,27                                         R100
143600H10A   TRX   SCAN9,3,30                                         R100
143700H11A   TRX   SCAN9,3,33                                         R100
143800H12A   TRX   SCAN9,3,36                                         R100
143900SCAN2  RPA   SCAN3                SET COMPARE ADDERSS            R100
144000       SBB   ACC,0,1                                            R100
144100       RPA   SCAN4                                              R100
```

```
144200SCAN5  CLA    TB00A+1          PICK UP SECOND WORD                R100
144300SCAN3  TRC    **               MATCH REST OF WORD                 R100
144400       TRU    SCAN1            NO MATCH                           R100
144500       TRU    SCAN1            NO MATCH                           R100
144600SCAN4  CLA    **               MATCH-TRANSFER                     R100
144700       RPA    PCT              TO ADDRESS                         R100
      ERRB   MOV    IR1,ERR2                                            R100
             MOV    IR2,IR1
             TRU    ERR+1
      ERR    MOV    IR1,ERR2
      ERR10  MOV    IR2,ERR3
             MOV    PCS,ERR1
145800       MOV    ACC,ERR4                                            R100
145900       MOV    QRG,ERR5                                            R100
146000       CLA    IR1                                                 R100
             SRL    12
146200       CLA    LL00C                                               R100
             ADD    =1,0,1
146300       SLL    12,0,1                                              R100
             STR    TD00A+15
146500       TRL    BSPR                                                R100
146600       CLA    IR1                                                 R100
146700       LDQ    =/7770000000                                        R100
146800       SLL    15,0,1                                              R100
146900       STR    ERR6                                                R100
147000STR    MOV    IR3,ERR11                                           R100
147100       MOV    IR4,ERR12                                           R100
147200       MOV    =1,IR2                                              R100
147300       RPT    13,0,1                                              R100
             MOV    LL00A+1,TD00A+1
147500       MOV    TB00W,IR2                                           R100
147600       MVZ    IR1                                                 R100
147700       MVZ    IR3                                                 R100
147800       MOV    =5,IR4                                              R100
147900STR1   CLA    TB00A,1                                             R100
             STR    TD00A+16,1
```

```
148100          TRX     *+1,3,1                                         R100
148200          TRX     STR1,1,1                                        R100
148300          CLA     ZERO                                            R100
                STR     TD00A+16,3
148500          TRX     *-1,3,1                                         R100
                MOV     ERR2,IR1
148800          MOV     ERR11,IR3                                       R100
148900          MOV     ERR12,IR4                                       R100
149000          MOV     ERR3,IR2                                        R100
149100          MOV     ERR4,ACC                                        R100
149200          MOV     ERR5,QRG                                        R100
149300          MOV     ERR1,PCT                                        R100
149400ERR1      HLT                                                     R100
149500ERR2      HLT                                                     R100
149600ERR3      HLT                                                     R100
149700ERR4      HLT                                                     R100
149800ERR5      HLT                                                     R100
149900ERR6      HLT                                                     R100
149920ERR11     HLT                             IR3                     R100
149925ERR12     HLT                             IR4                     R100
      BSPR      MOV     TC00W,IR2
                STR     TC00A,2
                ADB     TC00W,,1
                TRC     =100
150400          TRS                                                     R100
150500          TRU     *+1                                             R100
150600          MOV     *-2,BSPR                                        R100
150700          TRS                                                     R100
        W       TRL     ERR,1,FG1       ERROR ROUTINE                   R100
        W7      TRL     ERR,1,FG5       FIND NEXT WORD IN               R100
        W4      LSX     0,3,/12
        W3      CLA     TB00A                                           R100
                TRC     ID,3                                            R100
                TRU     W2                                              R100
                TRU     W2                                              R100
                CLA     ID+1,3                                          R100
```

```
                TRN     W8                                              R100
                RPA     PCT                                             R100
W8              RPA     W6                                              R100
                SBB     ACC,0,1                                         R100
                RPA     W5                                              R100
                CLA     TB00A+1                                         R100
W6              TRC     **                                              R100
                TRU     W2                                              R100
                TRU     W2                                              R100
W5              CLA     **                                              R100
                RPA     PCT                                             R100
W2              TRX     W3,3,3                                          R100
                TRL     A                                               R100
                TRU     W4                                              R100
                HLT     HFC3
HFC3            CLA     IR4             GET OUTPUT LOCATION
                RPA     OUACM           SET IN OUTPUT
                RPA     OUACM+1         AREA ACCUMULATION INSTRUCTIONS
                LOD     IR3,,IR1
                LXS     INTBF+6,2,4     SET INTERMEDIATE BUFFER LOCATION
                MOV     IR3,IRSAV       SET ALIGNMENT LOOP COUNT
ALIGN           LXS     4,3,3           SET 4 SHIFT COUNT AND 3 LOOP COUNT
                CLA     0,1             FIRST WORD OF LINE FROM BUFFER
                LOD     1,1,QRG         SECOND WORD OF LINE FROM BUFFER
                SLL     0,3,3           ALIGN SECOND WORD OF ROW
                STR     0,2             AND SET IN INTERMEDIATE BUFFER
                CLA     1,1             SECOND WORD OF ROW FROM BUFFER
                LOD     2,1,QRG         THIRD WORD OF ROW FROM BUFFER
                SLL     0,3,3           ALIGN FIRST WORD OF ROW
                STR     1,2             AND SET IN INTERMEDIATE BUFFER
                CLA     QRG             GET REMAINDER OF INPUT WORD
                LGM     MASKA           MASK IN POSITION 73-80
                STR     2,2             SET THIRD WORD OF ROW IN BUFFER
                ADB     IR1,,2          SET INPUT LOCATION FOR NEXT ROW
                ADB     IR2,,3          SET FOR NEXT ROW OF INTERMEDIATE
                TRX     ALIGN+1,3,12    PROCESS NEXT ROW AND SET SHIFT COUNT
```

```
        SBB     IRSAV,,1        DECRIMENT ROW GROUP COUNT
        TRZ     *+3             IF COUNT ZERO, PROCEED TO NEXT SECTN
        ADB     IR1,,1          SET INPUT LOCATION FOR NEXT GROUP
        TRU     ALIGN           ALIGN NEXT ROW GROUP
        LOD     OUACM,,IR2      OUTPUT BUFFER LOCATION FOR CLEAR
        RPT     13,0,1          CLEAR OUTPUT
        STR     0,2             BLOCK AREA
        LXS     INTBF,1,3       7-9 AND ZONE ZERO INDEX
ROWCM   CLA     6,1             FORM LOGICAL SUM
        LGA     9,1             OF BITS IN 12 AND 11 ROWS
        LGM     12,1            MASK BY BITS IN 0 ROW
        STR     0,1             SET ZONE ZERO BITS IN 4 ROW
        TRZ     *+4             IF ZERO, PROCEED TO 7-9 CHECK
        LGN     ACC             NEXATE WORD FROM 14 ROW
        LGM     12,1            REMOVE ZERO PUNCH BITS FOR ZONE 0
        STR     12,1            AND REPLACE IN BUFFER
        CLA     33,1            GET 7 ROW BITS
        LGM     39,1            MASK OFF BITS NOT CONTAINED IN 9 ROW
CONS3   STR     3,1             SET LOGICAL PRODUCT IN 13 ROW
        TRZ     *+4             SKIP BIT REMOVAL IF ZERO 13 ROW
        LGN     ACC             COMPLIMENT MASK IN ACC
        LGM     39,1            REMOVE 13 ROW BITS FROM 9 ROW
        STR     39,1            RESTORE 9 ROW WORD
        TRX     ROWCM,1,1       PROCESS NEXT WORDS OF ROWS
        LXS     INTBF,1,3       SET BUFFER LOCATION AND ROW WORD CNT
        LXS     0,3,14          SET ROW COUNT
RWCHK   CLA     0,1             GET WORD OF ROW
        TRZ     *+2             INDEX FOR NEXT WORD OF ROW IF 0
        TRU     *+6             PROCESS WORD AND REMAINDER OF ROW
        TRX     *-3,1,1         INDEX BUFFER LOCATION AND ROW WORD
        ADB     IR1,,1          ADJUST BUFFER LOC FOR TRX FALL
        LOD     CONS3,,IR2      RESET ROW WORD COUNT
        TRX     RWCHK,3,0       INDEX COUNT AND PROCESS NEXT ROW
        TRU     CDCVT           TRANSFER TO CODE CONVERSON IF FALL
        MOV     IR4,IRSAV       SAVE ROW NUMBER INDICATOR
        LOD     CHPRO,,IR3      INDEX FOR ROW VALUE SET-UP
```

```
        CLA     VLROW-1,4           GET EFFECTIVE VALUE FOR ROW
        STR     OPTAB-1,3           SET CHARACTER VALUE IN TABLE
        SHR     5                   POSITION FOR NEXT CHARACTER
        TRX     *-2,2,0             INDEX SET-UP LOOP
WDPRO   CLA     0,1                 GET INPUT WORD FROM BUFFER
        TRZ     WDZRO               IF ZERO, SKIP WORD PROCESS
        ADB     ZERO,,0             CLEAR ACC AND PUT WORD IN QRG
        LOD     WDPLA-1,2,IR4       SET OUTPUT WORD INDEX
        LOD     *+1,,IR3            WORD CHARACTER INDEX
CHPRO   SLL     6,,3                SELECT CHARACTER
        TRZ     CHIDX               SKIP CHARACTER IF ZERO
        SHL     31,,1               LEFT JUSTIFY AND SHIFT OFF 1 BIT
        SNS     *+2,,OVA            SKIP IF ZERO HIGH ORDER BIT
        LGA     OPTAB+5             INSERT HIGH ORDER CHARACTER
        SHL     1,,1                SHIFT OFF NEXT BIT
        SNS     *+2,,OVA            SKIP IF 0 SECOND BIT
        LGA     OPTAB+4             INSERT SECOND POSITION CHARACTER
        SHL     1,,1                SHIFT OFF THIRD BIT
        SNS     *+2,,OVA            SKIP IF 0 BIT
        LGA     OPTAB+3             INSERT THIRD POSITION BIT
        SHL     1,,1                SHIFT OFF FOURTH BIT
        SNS     *+2,,OVA            SKIP IF BIT IS ZERO
        LGA     OPTAB+2             INSERT FOURTH CHARACTER
        SHL     1,,1                SHIFT OFF FIFTH BIT
        SNS     *+2,,OVA            SKIP IF BIT IS 0
        LGA     OPTAB+1             INSERT FIFTH CHARACTER
        SHL     1,,1                SHIFT OFF SIXTH BIT
        SNS     *+2,,OVA            SKIP IF ZERO SIXTH BIT
        LGA     OPTAB               INSERT SIXTH CHARACTER
OUACM   ADD     **,4,3              ACCUMULATE INTO OUTPUT AREA
        STR     **,4                RESTORE OUTPUT WORD
CHIDX   CLA     QRG                 GET REMAINING WORD FROM QRG
        ADB     IR4,,1              INCREASE OUTPUT INDEX AND WORD TO Q
        CLA     ZERO                CLEAR ACCUMULATOR
        TRX     CHPRO,2,0           INDEX AND PROCESS REMAINING CHARACTE
WDZRO   TRX     WDPRO,1,1           INDEX AND PROCESS ROW WORDS
```

```
                ADB     IR1,,1              INCREASE INPUT INDEX
                LOD     IRSAV,,IR4          RESTORE ROW INDEX
                LXS     3,2,0               RESTORE ROW WORD INDEX
                TRX     RWCHK,3,0           INDEX AND PROCESS NEXT ROW
          CDCVT LOD     OUACM,,IR1          BUFFER LOCATION FOR CONVERSION
                LXS     14,2,0              OUTPUT BUFFER WORD INDEX
                LOD     MASKB,,QRG          SET MASK FOR CHARACTER LOAD
          WDCVT LXS     6,3,0               SET WORD CHARACTER CONVERSION INDEX
                CLA     0,1                 GET WORD FROM OUTPUT BUFFER
                CYS     6                   POSITION CHARACTER IN LOW ORDER ACC
                MSK     IR4                 PLACE CHARACTER IN INDEX FOR PICK-UP
                LGM     MASKC               CLEAR CHARACTER POSITION IN WORD
                LGA     CVTAB,4             INSERT CONVERSION CHARACTER
                TRX     WDCVT+2,2,0         INDEX AND PROCESS NEXT CHARACTER IN
                STR     0,1                 SET CONVERTED WORD IN OUTPUT BLOCK
                TRX     WDCVT,1,1           INDEX AND PROCESS NEXT OUTPUT WORD
                TRS
          CVTAB OCT     5,61,62,63,64,65,66,67,70,71,73,44,41,0,4,55,42,6,7,10
                OCT     11,12,13,14,15,16,45,75,40,1,57,52,41,17,20,21,22,23,24
                OCT     25,26,27,43,47,50,2,77,53,60,74,30,31,32,33,34,35,36,37
                OCT     72,56,51,3,76,54
          MASKA OCT     776000000000
          MASKB OCT     77
          MASKC OCT     777777777700
          VLROW VFD     6/0,6/9,31/0,6/8,31/0,6/7,31/0,6/6,31/0,6/5,31/0,6/4
                VFD     6/0,6/3,31/0,6/2,31/0,6/1,31/0,06/60,31/0,06/40
                VFD     6/0,06/20,31/0,06/3,31/0,06/12
          WDPLA DEC     12,6,0
          IRSAV BSS     1
          OPTAB BSS     6
150800LCTBLE    BSS     60                                              R100
150900XA        EQU     A1B-A1A                                         R100
151000XB        EQU     1CA-A1B                                         R100
151100XC        EQU     A1D-1CA                                         R100
151200XD        EQU     A1E-A1D                                         R100
151300XE        EQU     A1F-A1E                                         R100
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151400XF      EQU     A1G-A1F                                  R100
151500XG      EQU     A1H-A1G                                  R100
151600XH      EQU     A1I-A1H                                  R100
151700XI      EQU     A1J-A1I                                  R100
151800XJ      EQU     A1L-A1J                                  R100
151900XL      EQU     A1M-A1L                                  R100
152000XM      EQU     A1N-A1M                                  R100
152100XN      EQU     A1O-A1N                                  R100
152200XO      EQU     A1P-A1O                                  R100
152300XP      EQU     A1Q-A1P                                  R100
152400XQ      EQU     A1R-A1Q                                  R100
152500XR      EQU     A1S-A1R                                  R100
152600XS      EQU     A1T-A1S                                  R100
152700XT      EQU     A1U-A1T                                  R100
152800XU      EQU     A1V-A1U                                  R100
152900XV      EQU     A1W-A1V                                  R100
153000XW      EQU     A1Z-A1W                                  R100
153100XZ      EQU     A2A-A1Z                                  R100
153200FG1     EQU     1                                        R100
153300FG2     EQU     2                                        R100
153400FG3     EQU     3                                        R100
153500FG4     EQU     4                                        R100
153600FG5     EQU     5                                        R100
153700FG6     EQU     6                                        R100
153800FG7     EQU     7                                        R100
153900FG8     EQU     8                                        R100
154000FG9     EQU     9                                        R100
154100FG10    EQU     10                                       R100
154200FG11    EQU     11                                       R100
154300FG12    EQU     12                                       R100
154400FG13    EQU     13                                       R100
154500FG14    EQU     14                                       R100
15460000F0C   DEF     110                                      R100
15470001F0C   DEF     111                                      R100
15480002F0C   DEF     112                                      R100
15490003F0C   DEF     113                                      R100
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15500004F0C  DEF   114                                    R100
15510005F0C  DEF   115                                    R100
15520006F0C  DEF   116                                    R100
15530007F0C  DEF   117                                    R100
15540008F0C  DEF   120                                    R100
15550009F0C  DEF   121                                    R100
       IDA   SYN   W                                      R100
       IDE   SYN   W7                                     R100
       N5    SYN   SCAN                                   R100
155600A2B    SYN   A3A                                    R100
155700A4D    SYN   A3A                                    R100
155800A7E    SYN   A7C                                    R100
155900A8E    SYN   A2A                                    R100
156000A3I    SYN   A7C                                    R100
156100A3L    SYN   A3F                                    R100
156200A4L    SYN   A3F                                    R100
156300A5L    SYN   A5D                                    R100
156400A6L    SYN   A7D                                    R100
156500A4M    SYN   A2A                                    R100
156600A4O    SYN   A6D                                    R100
156700A3P    SYN   A7C                                    R100
156800A4P    SYN   A7D                                    R100
156900A5P    SYN   A2N                                    R100
157000A9P    SYN   A6D                                    R100
157100A3R    SYN   A3A                                    R100
157200A4R    SYN   A2A                                    R100
157300A8R    SYN   A3A                                    R100
157400A9R    SYN   A7C                                    R100
157500A10R   SYN   A6P                                    R100
157600A11R   SYN   A6D                                    R100
157700A6S    SYN   A2O                                    R100
157800A5T    SYN   A2G                                    R100
157900A2U    SYN   A11C                                   R100
158000A3U    SYN   A9L                                    R100
158100A4U    SYN   A10L                                   R100
158200A2V    SYN   A3F                                    R100
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158800          END     1                                          R100
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APPENDIX B

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